

Student Training Manual for

**CYBER FIXED MODULE DRIVE
SUBSYSTEM FAULT ISOLATION**

VOLUME 2

An Individualized Course

[illegible]

QA EDUCATION, NTHESE

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MODULE 5

FIXED MODULE DRIVE DIAGNOSTICS

This module will acquaint you with the FMD Subsystem diagnostics. You will learn the subsystem diagnostic hierarchy and the purpose of the modules, messages, and parameters of each diagnostic.

PRETEST

To begin this module, sign on to the PLATO terminal and read the objectives. If you feel you might be able to meet some of the objectives, take the module test. After evaluating the results of your test, PLM will assign the learning activities that relate to the objectives you did not meet. If you do not wish to take the test, ask for an assignment.

LEARNING ACTIVITIES

In the Assigned column below put a checkmark by each activity assigned to you by PLM. Proceed through the assigned activities and check off each activity as you complete it. You may choose to do all of the activities or do some activities more than once.

<u>Assigned</u>	<u>Completed</u>	<u>Activity</u>	<u>Description</u>	<u>Page</u>
_____	_____	5-A	Text Reading: FMD Diagnostics Overview. This activity describes the diagnostics and reference materials that are available for use with the FMD subsystem.	5-5
_____	_____	5-B	Exercise: Overview Review. This activity reviews learning activity 5-A.	5-7
_____	_____	5-C	Reference Reading: FMC Documentation. This activity acquaints you with the FMC documentation.	5-11
_____	_____	5-D	Text Reading: FMC Examples. This activity describes figures that illustrate the usage and features of FMC.	5-12

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<u>Assigned</u>	<u>Completed</u>	<u>Activity</u>	<u>Description</u>	<u>Page</u>
_____	_____	5-E	Exercise: FMC Review. This activity reviews learning activities 5-C and 5-D.	5-20
_____	_____	5-F	Reference Reading: FMD Documentation. This activity acquaints you with the FMD documentation.	5-23
_____	_____	5-G	Text Reading: FMD Examples. This activity describes figures that illustrate the usage and features of FMD.	5-25
_____	_____	5-H	Exercise: FMD Review. This activity reviews learning activities 5-F and 5-G.	5-35
_____	_____	5-I	Reference Reading: D88 Documentation. This activity acquaints you with the D88 documentation.	5-39
_____	_____	5-J	Text Reading: D88 Example. This activity describes a figure that illustrates the use and features of D88.	5-40
_____	_____	5-K	Exercise: D88 Review. This activity reviews learning activities 5-I and 5-J.	5-42
_____	_____	5-L	Reference Reading: FMU Documentation. This activity will acquaint you with the documentation and utility capabilities of FMU.	5-45
_____	_____	5-M	Exercise: FMU Review. This activity reviews the FMU documentation.	5-46
_____	_____	5-N	Reference Reading: 844 Diagnostics. This activity acquaints you with the 844 diagnostics D44 and DTC.	5-51
_____	_____	5-O	Text Reading: FMD-HPA Description. This activity describes three types of HPA reports as they apply to the FMD subsystem.	5-52

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<u>Assigned</u>	<u>Completed</u>	<u>Activity</u>	<u>Description</u>	<u>Page</u>
		5-P	Exercise: FMD-HPA Review. This activity reviews learning activity 5-O.	5-58

LEARNING ACTIVITY 5-A. TEXT READING: FMD DIAGNOSTICS OVERVIEW

This activity describes the diagnostics and reference materials that are available for use with the FMD subsystem.

OBJECTIVE

- You will be able to describe the purpose of the FMD subsystem diagnostics D44, D88, DTC, FMD, FMC, and the utility program FMU.

FMD DIAGNOSTIC OVERVIEW

There are three diagnostic tests for the 885 disk and controller: D88, FMC, and FMD. Documentation describing use and applications of these diagnostics is in the form of external documentation on microfiche and troubleshooting guides. Diagnostics for 844 disks on the 7155 controller include D44 and DTC. FMU is the flaw maintenance utility that can be used to maintain packs on both 844 and 885 disks.

The maintenance philosophy for this subsystem includes specific operator responsibilities. If a malfunction is indicated, the operator should execute the confidence test included in D88. This confidence test is intended to detect any failure and isolate the failure in the subsystem. Isolation messages include a report of preservice forecast group (PSFG). The PSFGs used are FMDC, FMDD, and FMDH to indicate failure of controller, disk unit, or HDA, respectively. D88 also includes tests for HDA surface analyses and troubleshooting modules for use by qualified CEs. Read section 1 of the Operator Troubleshooting Guide, publication number GF60456650, for an introduction to operator maintenance responsibilities. Then, continue reading from this point.

FMC and FMD are the error detection and isolation diagnostics for the controller and disk unit respectively. It would be appropriate for a CE to execute one of these diagnostics after D88 has isolated a failure. Messages from FMC or FMD will indicate cards to be replaced to correct logic failures and additional procedures to be performed to correct power supply or other problems.

Use of the diagnostic tests mentioned above is frequently associated with the 7155 Troubleshooting Guide, publication number RF60456010. You must take time to become familiar with the contents and organization of that manual. The preface contains a brief description

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of the 7155 Troubleshooting Guide contents and a list of documents that will be required for maintaining this subsystem. Section 1 of the 7155 Troubleshooting Guide will help you understand the manual organization, preliminary isolation and troubleshooting methods, and procedures for installing and executing diagnostics. Details of sections 2 and 3 will be discussed in later learning activities. Read the preface and section 1 of the 7155 Troubleshooting Guide noting the preceding considerations. Then continue reading from this point.

FMU enables reading flaw tables from disks, setting or clearing flaws, rewriting address fields (reformatting), as well as several special purpose operations. Two of these special operations (storing controlware to disk and writing diagnostic patterns) must be performed before FMC, D88 and FMD will execute without error indications. You may have noticed that details of using FMU are included in section 2 of the Operator Troubleshooting Guide (GF 60456650). In a later learning activity, you will study the documentation for FMU so that you will be able to make maximum use of the utility.

D44 and DTC are tests that provide confidence testing and error detection for 844 disks on the 7155 controller. The learning activities containing documentation for these tests will be of interest to the personnel of sites with this 844 equipment configuration.

As the troubleshooting guides indicate, these diagnostics exist as on-line MALET tests and off-line DEMOT tests. If you have not studied the CMSE course that includes DEMOT, read the DEMOT Reference Manual, publication number 60456310, before proceeding to the next learning activity. Note the DEMOT directives and default switch setting in the parameter display. Additional procedures for off-line execution are included in the lab module.

NOTE: The DEMOT Reference Manual has been discontinued. The DEMOT information can now be found in Section 7 of the MSL 100 Reference Manual, pub. No. 60455770, beginning with revision C.

LEARNING ACTIVITY 5-B. EXERCISE: OVERVIEW REVIEW

This activity reviews the FMD diagnostic overview.

OBJECTIVE

- You will be able to describe the purpose of the FMD subsystem diagnostics D44, D88, DTC, FMD, FMC, and the utility program FMU.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following questions, answer it with a word or words in the space provided after the question.

1. What is the definition of preservice forecast group?

PSFG codes identify sets of tools and parts to be brought on a service call

2. Which diagnostic includes an FMD subsystem confidence test?

D88

3. Which diagnostics are available for 844s on the 7155 controller?

DTC D44

4. Which routines maintain flaws and reformats 885 and 844 disks?

FMU

5. What is the device code for 885 drives?

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Learning Activity 5-B

6. Which D44 module should be executed before module 06?

D44-41

7. Which PSFG should be reported by D88 if the 885 has a logic chassis fault?

FMDD

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Learning Activity 5-B

The answers to this learning activity are on the following page.

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Learning Activity 5-B

ANSWERS TO LEARNING ACTIVITY 5-B

1. A set of tools and parts for servicing a failing part
(controller or disk drive) of the subsystem
2. D88
3. D44 and DTC
4. FMU
5. 7
6. D44(41)
7. FMDD

LEARNING ACTIVITY 5-C. REFERENCE READING: FMC DOCUMENTATION

This activity acquaints you with the FMC documentation.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic FMC.

Refer to figure 5-1 and note that the external FMC documentation is divided into five major parts. As you read the microfiche MALET FMC documentation, note the parameter definitions, operator communications, and module descriptions. Now locate the MALET documentation, publication number 53140094, microfiche labelled FMC and read it.

1. Introduction
2. Requirements
 - a. Hardware
 - b. Software
3. Operational procedure
 - a. Loading*
 - b. Parameter definitions
 - c. Module description index
4. Operator communication
 - a. Message format
 - b. Message dictionary
 - c. Error message
5. Description
 - a. General
 - b. Modules (FMC00-98)
 - 1) Purpose
 - 2) Method

*See 7155 Troubleshooting Guide, publication number RF60456010, procedures 1-1 and 1-6.

Figure 5-1. FMC Documentation Index

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Learning Activity 5-D

LEARNING ACTIVITY 5-D. TEXT READING:
FMC EXAMPLE

This activity describes figures that illustrate the use and features of FMC.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic FMC.

The figures were derived from listings that resulted from executing FMC with the NOS/BE MALET system at NTHESE. After the controller is powered on, the 4K memory must be loaded with controlware to make the controller operational. This autoloading procedure can be performed by executing FMC02 or FMC31.

Module two downloads controlware from the PPU to the 7155 memory. For this module to execute, MA721 controlware must be available as a MALET scratch file that is attached with the RFILE. Figure 5-2 illustrates the procedure for attaching the diagnostic and controlware. If module 31 is used to load controlware, FMU must have been previously executed to copy controlware on a disk.

```
18.18.27.OIS.  
18.18.52.ATTACH,RFILE,FMC,ID=CML31.  
18.18.52.PF CYCLE NO. = 002  
18.19.11.ATTACH,SCRATCH,MA721,ID=CML31.  
18.19.11.PF CYCLE NO. = 001  
18.19.19.MALET,KL.
```

Figure 5-2. Attaching Files For FMC

Figure 5-3 shows a MALET assign (A,) directive for equipment not included in the system EST. Most entries in the assign directive are available from MALET displays or system configuration information, but two of the entries require discussion. Since most modules of FMC are written with low level commands, an access level (AL,) of ten or higher is required.

```

13.19.48.DIRECTIVE=A,CH=2,DC=7,AL=10,EQ=0,UN=43
N.G0/DROP EST000 C02 E00 U43 AL0010.
VALIDATION GRANTED- EST000 C02 E00 U43 AL10 DC07.
13.20.21.DIRECTIVE=R,FMC
13.20.22.FMC00 - PARAMETER CHECK
13.20.23.FMC01 - ECHO FUNCTION TEST
13.20.23.FMC02 - AUTOLOAD TEST
13.20.31.FMC03 - NORMAL CHANNEL LOOP TEST
13.20.35.FMC04 - DEAD MAN TIMER TEST
13.20.35.// FMC04 NOT EXECUTED, NEEDS AL=0021,AL=0010 //
13.20.36.FMC07 - SPECIAL CHANNEL TEST
13.20.41.FMC15 - DATA PATH TEST, PART 1 OF 3
13.20.47.FMC16 - DATA PATH TEST, PART 2 OF 3
13.20.54.FMC17 - DATA PATH TEST, PART 3 OF 3
13.21.11.FMC18 - CONTROL WORD REGISTER TEST
13.21.11.FMC19 - BIT COUNTER REGISTER TEST
13.21.12.FMC21 - LOOP 885 DECODE TEST
13.21.34.FMC22 - LOOP 885 BUS TEST
13.21.56.FMC23 - LOOP 885 WRT/READ/TAG GATE TEST
13.21.57.FMC25 - SYNC BYTE SEARCH TEST
13.21.58.FMC27 - ECC REGISTER TEST
13.22.03.FMC28 - ECC REGISTER CLEAR TEST
13.22.01.FMC29 - ECC FUNCTIONAL TEST
13.22.01.FMC31 - AUTOLOAD FROM DISK TEST
13.22.03.FMC33 - WRITE VERIFY TEST
END OF TEST SERIES FMC33

```

Figure 5-3. Assign and Run FMC

Unit numbers in the assign directive for 885 disk units must be 40-47 or 50-57 if the controller contains the FV670 option (8 additional units). Notice that these unit number codes include bit 5 set indicating to the controller that an 885 is to be selected. Selection is defaulted to 844 units if bit 5 is clear.

Figure 5-3 shows that after the system granted validation, a run directive was issued and FMC execution began with default parameter and switch settings as shown in figure 5-4. Note that the modules are chained so that they all execute unless specific selections are made in the run directive. The lower numbered modules perform basic operational tests and higher numbered tests are increasingly difficult. Module 00 checks for valid parameter settings without accessing the controller. FMC01 performs a simple controller access that does not require controlware. It only requires that the

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Learning Activity 5-D**

controller processor be executing in its idle loop. If the processor is operational, it is returned to its idle loop in the one-K-ROM by a master clear that can be generated by power on, push button, or in response to an autoloading function. FMC02 loaded controlware and the following modules tested the controller logic. For this example, module 04 did not execute; it requires AL=21 since the channel could be left hung if the test failed.

Isolation enabling and capabilities of FMC are illustrated by figures 5-4 through 5-7. Figure 5-4 shows the FMC default parameters.

PARAMETERS IN OCTAL					
P0=0000	P1=0000	P2=0000	P3=0000	P4=0000	P5=0000
P6=0000	P7=0000	P8=0000	P9=0000	TL=0100	LL=1320

SWITCH STATUS					
ON - (SE) STOP ON ERROR			OFF - (RM) REPEAT MODULE		
OFF - (RT) REPEAT TEST			OFF - (SB) STANDBY PPU FOR I/O		
ON - (PL) PRINT LOG			ON - (DL) DAYFILE LOG		
ON - (KL) K/L DISPLAY			OFF - (RC) REPEAT CONDITION		

ASSIGN VALUES					
DC=0007	EST=0000	CH=0002	EQ=0000	UN=0043	
AL=0010	SN=000000	SHARE=NO			

Figure 5-4. FMC Default Parameters

The error message in figure 5-5 was produced as the result of installing a known bad logic card in location B22 of the 7155. FMC execution was started at module 03 with default parameters as shown in figure 5-4 and continued to module 18 where the error was detected and execution stopped. The first four lines printed in the error message indicate the controller failed, and the appropriate PSFC is FMDC. Also, the failing portion of controller logic is indicated--control word register. The fifth printed line refers to line 114 in the source code for FMC18 where this error was assigned number 6A007. The remainder of the message follows the standard form.

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Learning Activity 5-D

```

18.41.13.FMC18 - CONTROL WORD REGISTER TEST
13.41.14.
18.41.14. FMC - 7155 DISK CONTROLLER DIAGNOSTIC
18.41.14. FMC18 - CONTROL WORD REGISTER TEST
18.41.14. PRESERVICE FORECAST GROUP FMDG
18.41.14.
13.41.14. FMC18 - LINE 0114 - ERROR NUMBER 5A007
18.41.14.
18.41.14. UPPER 8 BITS - E000 A000 D000
18.41.14. LOWER 8 BITS - E000 A000 D000
13.41.14.
18.41.14. UNABLE TO FORCE LOST CONTROL WORD
HALT - STOPPED ON ERROR

```

Figure 5-5. Standard Error Message

Examine figure 5-6 and observe that P4 has been set to 4000 to enable isolation.

```

PARAMETERS IN OCTAL
P0=0000 P1=0000 P2=0000 P3=0000 P4=4000 P5=0010
P6=0000 P7=0000 P8=0000 P9=0000 TL=0100 LL=1265
-----
SWITCH STATUS
ON - (SE) STOP ON ERROR OFF - (RM) REPEAT MODULE
OFF - (RT) REPEAT TEST OFF - (SB) STANDBY PPU FOR I/O
ON - (PL) PRINT LOG ON - (DL) DAYFILE LOG
ON - (KL) K/L DISPLAY OFF - (RC) REPEAT CONDITION
-----
ASSIGN VALUES
DC=0007 EST=0000 CH=0002 EQ=0000 UN=0043
AL=0010 SN=000000 SHARE=NO

```

Figure 5-6. Isolation Enabled by P4

After this change, FMC18 was run again resulting in the error message shown in figure 5-7. It is virtually identical to the previous error message with the exception of the last line, which isolates the failure to four possible logic cards. In this case, the first recommended replacement is the actual faulty card.

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Learning Activity 5-D**

18.42.06.
18.42.06. FMC - 7155 DISK CONTROLLER DIAGNOSTIC
18.42.06. FMC18 - CONTROL WORD REGISTER TEST
18.42.06. PRESERVICE FORECAST GROUP FMDC
18.42.06.
18.42.06. FMC18 - LINE 0114 - ERROR NUMBER 6A007
18.42.06.
18.42.06. UPPER 8 BITS - E000 A000 0000
18.42.06. LOWER 8 BITS - E000 A000 0000
18.42.06.
18.42.07. UNABLE TO FORCE LOST CONTROL WORD
18.42.07.
18.42.07. SUCCESSIVELY REPLACE CARDS B22, B21, A19, AND A20.

Figure 5-7. Error Message With Isolation

Figure 5-8 is an example of an unexpected error message. This message resulted from attempting to execute FMC03 after the error stop, described in preceding paragraphs, without first returning the processor to its idle loop. If the processor is not executing in its idle loop, it cannot respond to functions from the PPU, hence the unexpected error in this case.

13.01.02.
13.01.02. FMC - 7155 DISK CONTROLLER DIAGNOSTIC
13.01.02. FMC03 - NORMAL CHANNEL LOOP TEST
13.01.02. FMC03 - LINE 0036 - ERROR NUMBER 63814
13.01.02.
13.01.02. B0 - B3 0143 0000 0000 0001
13.01.02. B4 - B7 0000 0000 0000 0000
13.01.02. B8 - B11 0000 0000 0000 0000
13.01.02. B12-B15 0000 0000 0000 0000
13.01.02.
13.01.02. UNEXPECTED ERROR
13.01.02.
13.01.02. THIS FAILURE CANNOT BE ISOLATED BY THE
13.01.02. DIAGNOSTIC SOFTWARE. SET RC AND USE
13.01.02. STANDARD TROUBLESHOOTING TECHNIQUES.
13.01.02.
13.01.02. FMC03 24024 L036 NO INACTIVE ON EQUIP FUNC

Figure 5-8. Unexpected Error Message

CYBER Fixed Module Drive
Learning Activity 5-D

For the unexpected error, essentially all significant information is presented in worded descriptions. The error number 63814 includes two hexadecimal numbers 63 and 814. Register B0 contains 0143, which is the octal equivalent of 63 HEX and indicates the test number as assigned in the source code. The MALET EC register reported 814 HEX as the error code that is equal to 4024 octal, and the significance of this code is reported in the last line of the message. MALET registers B0-B15 contents are reported, but the significance of these registers depends on their usage in the module. These registers do not provide a detail status report. The message to set RC refers to the repeat condition switch, which would enable looping some small portion of a module for scoping purposes.

As mentioned earlier, a pushbutton master clear could be used to force idle loop, or, as illustrated in figure 5-9, setting P5=1XXX and running FMC02 has the same effect. This software manipulation causes an autoloader function without a controlware download, and these conditions cause a master clear to return the processor to the idle loop.

```
13.38.55.DIRECTIVE=P,P5=1010
13.39.01.DIRECTIVE=R,FMC(02)
13.39.01.FMC02 - AUTOLOAD TEST
END OF TEST SERIES FMC02
13.39.10.DIRECTIVE=R,FMC03
13.39.11.FMC03 - NORMAL CHANNEL LOOP TEST
13.39.14.FMC04 - DEAD MAN TIMER TEST
13.39.14.// FMC04 NOT EXECUTED, NEEDS AL=0021,AL=0010 //
13.39.15.FMC07 - SPECIAL CHANNEL TEST
13.39.20.FMC15 - DATA PATH TEST, PART 1 OF 3
13.39.27.FMC16 - DATA PATH TEST, PART 2 OF 3
13.39.34.FMC17 - DATA PATH TEST, PART 3 OF 3
13.39.50.FMC18 - CONTROL WORD REGISTER TEST
13.39.51.
13.39.51. FMC - 7155 DISK CONTROLLER DIAGNOSTIC
13.39.51. FMC18 - CONTROL WORD REGISTER TEST
13.39.51. PRESERVICE FORECAST GROUP FMDC
13.39.51.
13.39.51. FMC18 - LINE 0114 - ERROR NUMBER 6A007
13.39.51.
13.39.51. UPPER 8 BITS - E000 A000 D000
13.39.51. LOWER 8 BITS - E000 A000 D000
13.39.51.
13.39.51. UNABLE TO FORCE LOST CONTROL WORD
13.39.51.
13.39.51. SUCCESSIVELY REPLACE CARDS B22, B21, A19, AND A20.
HALT - STOPPED ON ERROR
```

Figure 5-9. Force Idle Loop and Run FMC

CYBER Fixed Module Drive
Learning Activity 5-D

Now, some attention must be given to the significance of running module 02 if an error condition exists. You should be aware that a master clear that forces idle loop also causes the processor to execute the one-K-ROM diagnostics. Also, when controlware is loaded, it is accompanied by additional in-line diagnostics that execute from the two-K buffer and four-K-RAMS. Refer to figures 3-1 and 3-8 in 7155 Subsystem Reference Manual, publication number GF60455860, for additional information on in-line diagnostics.

Figure 5-10 shows a typical error message for an autoload failure. This failure occurred because of the same bad B22 card used for previous examples.

18.38.47.
18.38.47. FMC - 7155 DISK CONTROLLER DIAGNOSTIC
18.38.47. FMC02 - AUTOLOAD TEST
18.38.47. PRESERVICE FORECAST GROUP FMDG
18.38.47.
18.38.47. FMC02 - LINE 0056 - ERROR NUMBER 62002
18.38.47. STATUS ERROR W0000 E0000 A7777 D7777
18.38.47.
18.38.47.
18.38.47. FULL AUTOLOAD FAILED
18.38.47.
18.38.47. ADDITIONAL ERROR INFORMATION IS
18.38.47. PRESENTED ON THE 7155-S LED-S.
HALT - STOPPED ON ERROR

Figure 5-10. Autoload Failure

Figure 5-11 shows LED information referred to by the autoload error message.

CYBER Fixed Module Drive
Learning Activity 5-D

B Connected

Processor
Output Channel 0
3, 5, 7

A = 0042
P = 233F

Figure 5-11. 7155's LED Error Information

The autoloader failure message and LED information must be correlated with 7155 Troubleshooting Guide tables. Refer to figure 5-11 and 7155 Troubleshooting Guide, table 2-1, publication number RF60456010. For this example, all assumptions in the DLT were met and the power supply meters were indicated in tolerance voltage levels (first DLT question - no). The second DLT question about control memory and ROM parity errors is answered, no. The third question is answered yes, since P = 233F, and you are directed to 7155 Troubleshooting Guide, table 2-4. Figure 5-11 indicates A = 0042, which is used in the 7155 Troubleshooting Guide, table 2-4, to indicate that the first card to be replaced, to attempt to correct the autoloader failure, is B22. During the lab you will learn more about the isolation available in the 7155 Troubleshooting Guide.

Read through section 2 of the 7155 Troubleshooting Guide. Then continue reading from this point.

The full capabilities of isolation by FMC are available on-line, as these examples have shown, and off-line. However, there may be some limitations depending on system configuration. Refer to the note in 7155 Troubleshooting Guide procedure 1-6 for on-line limitations; for labs including off-line execution, you will be provided with additional procedural documentation.

You have now completed learning activity 5-D.

CYBER Fixed Module Drive
Learning Activity 5-E

LEARNING ACTIVITY 5-E. EXERCISE:
FMC REVIEW

This activity reviews the FMC documentation and the FMC examples.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic FMC.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following questions, answer it with a word or words in the space provided after the question.

1. Which modules of FMC can be used to load controlware to the 7155 4K memory?

FMC 02
FMC 31

2. Which modules of FMC will execute without having controlware loaded in the 7155?

FMC 00 FMC 31
FMC 01
FMC 02

3. Does FMC21 require the use of a disk unit?

NO

4. How can you select an error message to be displayed with suggested logic card replacements?

P 4 = 4000

CYBER Fixed Module Drive
Learning Activity 5-E

5. Describe a software method of forcing the 7155 processor to return to its idle loop.

P5 = 1000
Run FMC02

6. Where can you find reference materials for procedures to follow if an autoloader failure occurs? Specify tables or procedures which might be used.

7155 - troubleshooting guide
Table 2A
1-4

7. What address does the P register LEDs indicate if the 7155 processor is executing in its idle loop?

21BF

8. What access level should be assigned to enable all modules of FMC except module four to execute?

AL = 10

9. If an assign statement specifies a device code of 7, what is the maximum range of unit numbers that can be used?

4-0 - 47 50-57

10. Where can you find reference materials for procedures to follow to correct a controller power failure? Specify tables or procedures that might be used.

7155 troubleshooting guide
1-2A
1-3
2-2

Procedure 2-7

CYBER Fixed Module Drive
Learning Activity 5-E

ANSWERS TO LEARNING ACTIVITY 5-E

1. FMC02 and FMC31
2. modules 00, 01, 02, 31
3. No
4. set P4=4000 to enable isolation.
5. set P5=1000 and run FMC(02).
6. 7155 Troubleshooting Guide, table 1-3, which refers to table 2-3, and 2-1, which refers to table 2-4
7. P = 21BF(HEX) - refer to 7155 Troubleshooting Guide, table 1-3.
8. AL=10
9. unit numbers 40 through 57
10. 7155 Troubleshooting Guide, table 1-3 refers to table 1-4, which refers to table 2-2, which refers to power supply procedures and figures through 7155 Troubleshooting Guide, section 2.

LEARNING ACTIVITY 5-F. REFERENCE READING: FMD DOCUMENTATION

This activity acquaints you with the FMD documentation.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic FMD.

See figure 5-12 and note that the external documentation is divided into five major parts. As you read the microfiche MALET FMD documentation, note the parameter definitions and module descriptions. Now, locate the MALET documentation (53140094) microfiche labeled FMD and read it.

CYBER Fixed Module Drive
Learning Activity 5-F

Preface

1. Introduction
2. Requirements
 - a. Hardware
 - b. Software
3. Operational procedure
 - a. Loading*
 - b. Parameters (P0-P9)
 - c. Section description index
4. Operator communication
 - a. Message formats
 - b. Message dictionary
5. Descriptions
 - a. General
 - b. Module descriptions

*See 7155 Troubleshooting Guide, publication number RF60456010, procedures 1-1 and 1-4.

Figure 5-12. FMD Documentation Index

LEARNING ACTIVITY 5-G. TEXT READING: FMD EXAMPLES

This activity describes figures which illustrate the usage and features of FMD.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic FMD.

The figures are derived from listings that resulted from executing FMD with the NOS/BE MALET system at NTHESE. Before executing FMD, the subsystem was powered on, controlware was loaded using FMC02, enable switches on the 7155 and 885 were turned on, and system maintenance switch on the 885 was turned on.

The modules through number 70 are chained so that all will run unless specific modules are specified in the run directive. The test is arranged to test basic 885 operation during the lower modules execution, and more complex operations are tested by higher numbered modules. Therefore, for isolation, the modules should be run in order.

CYBER Fixed Module Drive
Learning Activity 5-G

Figure 5-13 shows the default parameter values for FMD. Assigned values include unit numbers of 40 to 57. Access level four is acceptable for all modules except 73, which requires access level 10.

PARAMETERS IN OCTAL					
P0=0000	P1=0000	P2=0000	P3=0000	P4=0000	P5=0000
P6=0000	P7=0000	P8=0000	P9=0000	TL=0100	LL=1750

SWITCH STATUS					
ON - (SE) STOP ON ERROR			OFF - (RM) REPEAT MODULE		
OFF - (RT) REPEAT TEST			OFF - (SB) STANDBY PPU FOR I/O		
ON - (PL) PRINT LOG			ON - (DL) DAYFILE LOG		
ON - (KL) K/L DISPLAY			OFF - (RC) REPEAT CONDITION		

ASSIGN VALUES					
DC=0007	EST=0000	CH=0002	EQ=0000	UN=0043	
AL=0004	SN=000000	SHARE=NO			

Figure 5-13. FMD Default Parameters

Figure 5-14 is an example of an operator intervention message. Some modules require certain operator actions on the disk unit and then issue a go directive to get the test running again. As the test continues, it will check for a new status from the switch that was changed. If the switch is not changed during the stop, an error message and stop will occur. Setting P5=10 disables operator intervention tests by causing the switch testing portions of the modules to be bypassed.

A problem was induced in the tested unit by grounding the index mark signal on the card at location 38. With parameters still set at default, values FMD were run and the error message in figure 5-15 resulted.

CYBER Fixed Module Drive
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18.24.19. FMD - FIXED MODULE DRIVE DIAGNOSTIC
18.24.19. FMD 30 - MAINT/RD/SWITCH TEST
18.24.19. PRESERVICE FORECAST GROUP FMDD
18.14.19.
18.24.19.
18.24.19.
18.24.19.
18.24.19.
18.24.19.
18.24.19. MANUAL INTERVENTION STOP
18.24.19. REMOVE UNIT FROM SYSTEM MAINTENANCE.

Figure 5-14. Operator Intervention Message

10.17.53.DIRECTIVE=R,FMD
10.17.53.FMD00 - CHECK PARAMETERS
10.17.54.FMD01 - FMD PRELIMINARY TEST
10.17.54.
10.17.54. FMD - FIXED MODULE DRIVE DIAGNOSTIC
10.17.54. FMD01 - FMD PRELIMINARY TEST
10.17.54. PRESERVICE FORECAST GROUP FMDD
10.17.54.
10.17.54. FMD01 - LINE 0046 ERROR CODE 01023
10.17.54.
10.17.54.
10.17.54.
10.17.54.
10.17.54. POSSIBLE HDA SEQUENCE ERROR.
HALT - STOPPED ON ERROR

Figure 5-15. FMD Standard Error Message

CYBER Fixed Module Drive
Learning Activity 5-G

Then with P4=4000 to enable isolation, the test was run and produced the error message in figure 5-16, referring to 7155 Troubleshooting Guide, table 3-1. In this case the 7155 Troubleshooting Guide DLTs provide little assistance, but notice the results of running FMD02 and FMD03 in figures 5-17 and 5-18. Both of these messages specify that the index mark is missing and, among other operations, recommend replacing the faulty card in location 38.

```
10.18.15. DIRECTIVE=P,P4=4000,P5=10
10.18.26. DIRECTIVE=R,FMD
10.18.26. FMD00 - CHECK PARAMETERS
10.18.27. FMD01 - FMD PRELIMINARY TEST
10.18.27.
10.18.27. FMD - FIXED MODULE DRIVE DIAGNOSTIC
10.18.27. FMD01 - FMD PRELIMINARY TEST
10.18.27. PRESERVICE FORECAST GROUP FMDO
10.18.27.
10.18.27. FMD01 - LINE 0046 ERROR CODE 01023
10.18.27.
10.18.27.
10.18.27.
10.18.27. POSSIBLE HDA SEQUENCE ERROR.
10.18.27.
10.18.27. GO TO TABLE 3-1 IN TROUBLESHOOTING GUIDE.
HALT - STOPPED ON ERROR
```

Figure 5-16. FMD Error Message With Isolation

CYBER Fixed Module Drive
Learning Activity 5-G

```
10.18.40.  
10.18.41. FMD - FIXED MODULE DRIVE DIAGNOSTIC  
10.18.41. FMD02 - STATIC I/O TEST 1  
10.18.41. PRESERVICE FORECAST GROUP FMD0  
10.18.41.  
10.18.41. FMD01 - LINE 0042 ERROR CODE 01004  
10.18.41.  
10.18.41.  
10.18.41.  
10.18.41.  
10.18.41. INDEX MARK NOT DETECTED AT CONTROLLER INTERFACE  
10.18.41. WITH DEVICE NOT SELECTED.  
10.18.41.  
10.18.41. 01. CHECK CHANNEL ENABLE SWITCHES FOR  
10.18.41. APPROPRIATE CHANNEL ENABLED.  
10.18.41. 02. CHECK FOR LOOSE CABLES.  
10.18.41. 03. CHECK IF DEVICE IS UP TO SPEED AND READY  
10.18.41. INDICATOR LIT. IF NOT, USE HDA SEQUENCE  
10.18.41. TROUBLE SHOOTING MAP.  
10.18.41. 04. REPLACE PWBS ONE AT A TIME IN THE FOLLOWING  
10.18.41. ORDER - A/803, A/838, A/828.  
HALT - STOPPED ON ERROR
```

Figure 5-17. FMD02 Isolation Message

```
10.18.58.  
10.18.58. FMD - FIXED MODULE DRIVE DIAGNOSTIC  
10.18.58. FMD03 - STATIC I/O TEST 2  
10.18.58. PRESERVICE FORECAST GROUP FMD0  
10.18.58.  
10.18.58. FMD02 - LINE 0036 ERROR CODE 01014  
10.18.58.  
10.18.58.  
10.18.58.  
10.18.58.  
10.18.58. INDEX MARK NOT ACTIVE AFTER SELECTION.  
10.18.58.  
10.18.58. 01. CHECK FOR LOOSE CABLES.  
10.18.58. 02. CHECK CHANNEL ENABLE SWITCHES FOR  
10.18.58. APPROPRIATE CHANNEL ENABLED.  
10.18.58. 03. VERIFY HDA IS READY AND ON CYLINDER. IF NOT,  
10.18.58. USE HDA SEQUENCE TROUBLE SHOOTING MAP.  
10.18.58. 04. REPLACE PWBS ONE AT A TIME IN THE FOLLOWING  
10.18.58. ORDER - A/803, A/838.  
HALT - STOPPED ON ERROR
```

Figure 5-18. FMD03 Isolation Message

CYBER Fixed Module Drive
Learning Activity 5-G

Do not draw the conclusion from the preceding discussion that the 7155 Troubleshooting Guide is not valuable in isolation. The static I/O tests of modules 2 and 3 can provide status reports that are not readily available by other means. Frequently, after a failure in FMD01, it is worthwhile to run FMD02 and 03 for additional symptoms and recommendations before resorting to the 7155 Troubleshooting Guide. Once the resources of modules 01, 02, and 03 have been expended, then the 7155 Troubleshooting Guide will be invaluable.

Refer now to 7155 Troubleshooting Guide, table 3-1 and relate the entries in this table to the procedures and figures found in section 3. As an example of using table 3-1, assume an HDA sequence error was reported by FMD. Assume that device A disk rotates and comes ready, but device B disk does not. Table 3-1 refers to table 3-3. Read the assumptions of this table. Consider power up in local mode, motor thermal not tripped, and 60-Hz circuit breaker not tripped. With the above conditions given, you should arrive at the question, is drive motor B rotating?

From there, examine the drive motor brake. The second reference is to procedure 3-16 (isolate motor B failure). In this procedure, you are directed to make several power supply tests and take actions such as replacing some of the A6KX relays or B31 or 32 logic cards that are involved in the B HDA sequence.

A bad card was installed in device A, logic chassis location 32, to produce the error reports shown in figures 5-18A through 5-18D. With this problem, the A motor spins, but device A does not get ready, and B motor spins only if B is started before A. In this case, FMD01, 02, and 03 provide little information. If you follow the FMD01 directions shown in figure 5-18A, you may end up replacing the servo power amplifier or even the HDA. As you know from the given conditions, this action would be entirely inappropriate. To avoid this situation, correlate the detailed status with the power on states identified in table 5-1.

TABLE 5-1. POWER ON SEQUENCE

Power On State	HDA Sequence Latches		
	4	2	1
0	0	0	0
1	0	0	1
3	0	1	1
2	0	1	0
6	1	1	0

CYBER Fixed Module Drive
Learning Activity 5-G

Table 5-1 illustrates how the states of the HDA sequence latches are used to define the power-on sequence state. If all latches are clear, as they are at the initiation of power-on, state 0 is defined. From that point, sequence latches should set or clear as indicated by ones and zeros in the table to enable a progression to state 6, which is maintained until a power-off is initiated. To reach state 6, the disk will have come up to speed, and the heads will have moved from the home position to cylinder 0. The sequence latches and the circuits for enabling their setting or clearing are contained on logic cards in locations 31 and 32.

See figure 5-18C and note that the bad card in location 32 caused detailed status word 2 to be 0040 instead of 0343 as it would be had the HDA sequence completed successfully. Bits 5, 6, and 7 should be set, and bits 2, 3, and 4 should be clear. Compare the bit definitions in figure 5-18D with the reported status of 0040. The HDA sequence did not complete, and, with only sequence latch 2 set, the power-on sequence stopped in state 2.

```
17.04.17.DIRECTIVE=R,FMD  
17.04.18.FMD00 - CHECK PARAMETERS  
17.04.19.FMD01 - END PRELIMINARY TEST  
17.04.19.  
17.04.19. END - FIXED MODULE DRIVE DIAGNOSTIC  
17.04.19. FMD01 - END PRELIMINARY TEST  
17.04.19. PRESERVICE FORECAST GROUP FMD0  
17.04.19.  
17.04.19. FMD01 - LINE 0046 ERROR CODE 01023  
17.04.19.  
17.04.19.  
17.04.19.  
17.04.19. POSSIBLE HDA SEQUENCE ERROR.  
17.04.19.  
17.04.19. GO TO TABLE 3-1 IN TROUBLESHOOTING GUIDE.  
HALT - STOPPED ON ERROR
```

Figure 5-18A. FMD01 Error Report

CYBER Fixed Module Drive
Learning Activity 5-G

17.04.30.	FMD - FIXED MODULE DRIVE DIAGNOSTIC
17.04.30.	FMD03 - STATIC I/O TEST 2
17.04.30.	PRESERVICE FORECAST GROUP FMD0
17.04.30.	
17.04.30.	FMD02 - LINE 0022 ERROR CODE 01011
17.04.30.	
17.04.30.	
17.04.30.	
17.04.30.	READY AND SAFE NOT ACTIVE AFTER RAISING SELECT.
17.04.30.	
17.04.30.	01. CHECK FOR LOOSE CABLES.
17.04.30.	02. CHECK CHANNEL ENABLE SWITCHES FOR
17.04.30.	APPROPRIATE CHANNEL ENABLED.
17.04.30.	03. VERIFY HDA IS READY AND ON CYLINDER. IF NCT,
17.04.30.	USE HDA SEQUENCE TROUBLE SHOOTING MAP.
17.04.30.	04. REPLACE PWBS ONE AT A TIME IN THE FOLLOWING
17.04.30.	ORDER - A/B23, A/B22, A/B24, A/B16.
HALT - STOPPED ON ERROR	

Figure 5-18B. FMD02, 03 Error Report

CYBER Fixed Module Drive
Learning Activity 5-G

```

17.04.41.DIRECTIVE=R,FMD70
17.04.42.FMD70 - SERVO TEST
17.04.42.
17.04.42. FMD - FIXED MODULE DRIVE DIAGNOSTIC
17.04.42. FMD70 - SERVO TEST
17.04.42. PRESERVICE FORECAST GROUP FMD0
17.04.43.
17.04.43. FMD70 - LINE 0017 ERROR CODE 5225
17.04.43.
17.04.43. FUNCTION CODE = 0000
17.04.43.
17.04.43.
17.04.43. FMD70 55225 1017 ABNORMAL GENERAL STATUS
17.04.43. WORD DETAILED STATUS (OCTAL)
17.04.43. GENERAL STATUS 010 0000 0040 0000 6140 0000
17.04.43. = 5020B 060 0000 0004 0427 1440 7001
17.04.43. 110 0000 0000 2112 0062 0001
17.04.43. 160 0004 0000 1012 0001 1412
HALT - STOPPED ON ERROR

```

Figure 5-18C. FMD 70, Detail Status Report

11	10	9	8	7	6	5	4	3	2	1	0
844: NOT APPLICABLE											
ADDRESS CHECKWORD ERROR	NONCORRECT- ABLE AD- DRESS CHECK- WORD ERROR	DATA CHECKWORD ERROR	NONCORRECT- ABLE DATA CHECKWORD ERROR	885: HDA SEQUENCE COMPLETE	885: SEQUENCE LATCH 4	885: SEQUENCE LATCH 2	885: SEQUENCE LATCH 1	885: SEQUENCE CHECK LATCH	885: INHIBIT HDA CYCLE	885: AIR SWITCH LATCH	885: MOTOR AT SPEED SWITCH LATCH

Figure 5-18D. Detail Status Word 2

CYBER Fixed Module Drive Learning Activity 5-G

This example illustrates the fact that there will be problems that are not directly isolated by the diagnostics and 7155 Troubleshooting Guide. However, additional information may be available in detailed status that can be obtained from D88 or certain modules of FMD. If diagnostics indicate an HDA sequence error, corrective action might well include replacing logic cards 31 and 32. Also, it is reasonable to request additional help before changing an HDA.

You have now completed learning activity 5-G.

LEARNING ACTIVITY 5-H. EXERCISE: FMD REVIEW

This activity reviews the FMD documentation and the FMD example.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic FMD.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following questions, answer it with a word or words in the space provided after the question.

1. If FMD reports a servo error, where can you find a procedure for adjusting the servo velocity?

Procedure 36

2. Which module of FMD must be used for making the servo velocity adjustment?

FMD-70

3. What access level should be assigned for all modules of FMD to execute?

10

4. How can you enable FMD error messages to include suggested logic card replacements and disable checking the switches on the logic card in location 20?

~~Par 36~~

P4 = 4000

P5 = 10

CYBER Fixed Module Drive
Learning Activity 5-H

5. Assume (in local mode) you press the B start switch for an 885 disk storage unit and device B becomes ready. Then press the A start switch, but the A device does not become ready, and FMD01 reports HDA sequence error for this disk. What tables or procedures would you refer to in the 7155 Troubleshooting Guide?

3-1

6. If FMD01 reports HDA sequence error, what other modules might provide significant information?

FMD02 FMD03

7. Which modules of FMD do not execute unless specifically selected in the run directive?

FMD 71, 72, 73,

8. If an 885 drive is connected to port 5 on the 7155 I/O connector panel, what unit number would have to be assigned to run FMD on this unit?

4 5

9. If you power-on the controller and 885 but the 885 drive does not come ready, should you run FMD before any other diagnostics?

NO LOAD CONTROL WARE FIRST

CYBER Fixed Module Drive
Learning Activity 5-H

The answers to this learning activity are on the following page.

CYBER Fixed Module Drive
Learning Activity 5-H

ANSWERS TO LEARNING ACTIVITY 5-H

1. 7155 Troubleshooting Guide, table 3-1 refers to procedure 3-6.
2. FMD70
3. AL=4 for all modules except 73, which requires AL=10.
4. set P4=4000 and P5=10
5. 7155 Troubleshooting Guide, table 3-1 will refer to other tables or procedures.
6. FMD02 and 03
7. FMD71, 72, and 73.
8. 45
9. FMC should be used to load controlware.

LEARNING ACTIVITY 5-I. REFERENCE READING: D88 DOCUMENTATION

This activity acquaints you with the D88 documentation.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic D88.

As you read the microfiche MALET D88 documentation, note the parameter definitions, module descriptions, and the three divisions of the test. Now, locate the MALET documentation (53140094) microfiche, labeled D88, and read it.

CYBER Fixed Module Drive
Learning Activity 5-J

LEARNING ACTIVITY 5-J. TEXT READING: D88 EXAMPLE

This activity describes figure 5-19, which illustrates the usage and features of D88.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic D88.

```

09.38.59.DIRECTIVE=A,CH=2,AL=4,DC=7,UN=40,EQ=0
N.G0/DROP EST000 C02 E00 U40 AL0004.
VALIDATION GRANTED- EST000 C02 E00 U40 AL04 DC07.
09.39.16.DIRECTIVE=R,D88
09.39.16.D8801 - RESERVE CONTROLLER
09.39.17.D8803-ZERO WORD AUTOLOAD TST
09.39.18.D8805 - GENERAL STATUS TEST
09.39.19.D8807 - DETAILED STATUS TEST
09.39.20.D8809-DIAGNOSTIC WRT/RO TEST
09.39.21.D8811 - READ COUPLER BUFFER
09.39.24.D8813-SEEK TIME MEASUREMENT
09.39.25. D88 - FMD CONFIDENCE TEST
09.39.25. D8813-SEEK TIME MEASUREMENT
09.39.25. PRESERVICE FORECAST GROUP (FMD)
09.39.25.
09.39.25. D88 ABORT ON .RES DRIVE. COMMAND
09.39.25. D8813 E5225 L023 ABNORMAL GENERAL STATUS
09.39.25. LAST FUNCTION = 0008 (CONNECT)
09.39.25. WT=0000 RETRIES=00 MARGINS=00 ERRORS=0001
09.39.25.
09.39.25. WORD DETAILED STATUS (OCTAL)
09.39.25. 1 0000 0340 0000 6140 0000
09.39.25. LAST GENERAL 5 0000 0004 0437 0450 3100
09.39.25. STATUS= 50208 110 0000 0001 2112 0022 0111
09.39.25. 160 0004 0000 1012 0001 1412
09.39.25.
09.39.25. FMD SEEK TIMEOUT ERROR.
HALT - STOPPED ON ERROR

```

Figure 5-19. D88 Message

Figure 5-19 shows a D88 error message that resulted from running the test with the same problem used for FMD examples--grounded index

CYBER Fixed Module Drive
Learning Activity 5-J

mark on the logic card in location 38. For many D88 messages, general and detail status words have to be decoded if more than the worded information is desired. See the 7155 Subsystem Reference Manual publication number GF60455860, appendix C, which contains tables showing significant bits of detail status for various error conditions. From the error message of the example, the error occurred after a connect attempt, and general status was reported as 5020. These conditions lead to table C-1.7, which shows that in this case all status words are significant except the upper three bits of words 13, 14, and 15. Refer to table 3-2, figure 3-2 and table 3-3 for status bit definitions, and notice that for the example bit 11 of word 9 is clear, which indicates that the index mark is missing. You should recall from the FMD examples that the test provided a more straightforward indication of the problem, and since the D88 message reports a PSFG of FMDD, the appropriate action would be to execute FMD.

CYBER Fixed Module Drive
Learning Activity 5-K

LEARNING ACTIVITY 5-K. EXERCISE: D88 REVIEW

This activity reviews the D88 documentation and the D88 example.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the diagnostic D88.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following questions, answer it with a word or words in the space provided after the question.

1. Which modules of D88 form the confidence test?

1 - 39

2. Which D88 parameters must be changed from the default values to execute the confidence test?

none

3. Which modules of D88 can be used for surface testing an HDA?

40 - 46

4. Which of the surface testing modules require the longest time to execute, and how long a time does it require?

41 6 hour 19 minutes

CYBER Fixed Module Drive
Learning Activity 5-K

5. List the steps of a procedure that can be used to enable a scoping loop.

SETSW RM
CLRSW SE
Run D88XX

6. What access level must be assigned to execute the confidence test of D88?

J

CYBER Fixed Module Drive
Learning Activity 5-K

ANSWERS TO LEARNING ACTIVITY 5-K.

1. modules 1-39
2. none
3. modules 40-46
4. module 41 requires 6 hours 19 minutes. (Refer to P.112 of D88 documentation.)
5. SETSW,RM
CLRSW,SE
RUNXX where XX is the module number to be repeated.

or
SETSW,RC
CLRSW,SE
GO
to loop on a condition.
6. AL=3

**LEARNING ACTIVITY 5-L. REFERENCE READING:
FMU DOCUMENTATION**

This activity will acquaint you with the documentation and utility capabilities of FMU.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the utility program FMU.

As its title indicates, much of the FMU has to do with maintenance flaw information on the disk packs.

Refer to appendix D in the 7155 Subsystem Reference Manual, publication number 60455860 and review the HDA flaw information. Then, continue reading from this point.

Locate the MALET documentation (53140094) microfiche, labeled FMU, and read it. Then continue reading from this point.

Read the Operator's Troubleshooting Guide, publication number 60456650, section 2. Note the flaw maintenance procedures and the references to special statements in appendix A of the Troubleshooting Guide. Additional procedural information will be provided during the laboratory exercises.

CYBER Fixed Module Drive
Learning Activity 5-M.

LEARNING ACTIVITY 5-M. EXERCISE: FMU REVIEW

This activity reviews the FMU documentation.

OBJECTIVE

- You will be able to describe the purpose of the parameters, modules, and messages of the utility program FMU.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following questions, answer it with a word or words in the space provided after the question.

1. Which modules of FMU must be executed to condition an HDA before FMC31 will execute error free?

FMU 21

2. Which module of FMU must be executed to condition an HDA for D88 and FMD data compare operations?

FMU 23

3. List the address ranges for an HDA.

- a. Cylinder 0 to 1512
- b. Track (head) 0 to 47
- c. Physical Sector 0 to 41

4. Answer the following questions.

- a. Which module of FMU is used to store controlware on an HDA at cylinder 1511(8), track 2?

FMU 21

CYBER Fixed Module Drive
Learning Activity 5-M

- b. How many sector flaw entries must be made in the utility map for the controlware track?

=y1511 track 2 sec 41, 40, 37, must be flawed

- c. How many sectors remain for storing controlware?

37₈ 31
0-36

5. How can HDA track flaws (only) from the utility map be displayed and printed?

FMU 03 PO=0001

6. If the utility map of an HDA is destroyed and no copy is archived, list the steps of a procedure to restore a copy of the factory map to the utility map track.

FMU 17
PO=0001 FMU 20

7. Answer the following questions.

- a. Does FMU provide verification of data fields on a disk?

NO

- b. How can this verification be achieved?

D88

8. How could you verify that a sector listed in an HDA utility map is actually a skipped (flawed) sector on the disk?

FMU 16

CYBER Fixed Module Drive
Learning Activity 5-M

9. Answer the following questions.

- a. When using FMU05, must a logical or physical sector number be specified to be flawed?

Physical

- b. Assume physical sector 2 is already flawed, and it is necessary to flaw logical sector 3. To what value should parameter 3 be set for FMU05?

P3 = 0004

10. Which modules of FMU make use of parameters P8 and P9?

FMU 14
FMU 53

CYBER Fixed Module Drive
Learning Activity 5-M

The answers to this learning activity are on the following page.

CYBER Fixed Module Drive
Learning Activity 5-M

ANSWERS TO LEARNING ACTIVITY 5-M

1. FMU21 copies controlware to the HDA for FMC31 to use. FMU05 must have been run to flaw the controlware track before module 21 is executed. Refer to module descriptions on FMU microfiche.
2. FMU23 - write diagnostic tracks
3. a. 1512 (octal) or 842 (decimal), 843 is reserved for future use
b. 0047 (octal) or 39 (decimal)
c. 0041 (octal) or 33 (decimal)
4. a. Module 21
b. three
c. 37 (0-36 octal) or 31 (0-30 decimal)
5. Set PO=0001 and run FMU03
6. run FMU17
set P5=0001
run FMU20
7. a. no
b. with D88 parameter-driven modules
8. execute FMU16 or FMU15
9. a. physical
b. P3=0004, refer to operator Troubleshooting Guide, procedure 2-5.
10. modules 14 and 53, refer to Operator Troubleshooting Guide, table 2-1

LEARNING ACTIVITY 5-N. REFERENCE READING: 844 DIAGNOSTICS

This activity acquaints you with the 844 diagnostic D44 and DTC.

OBJECTIVE

- You will be able to describe the purpose of the FMD subsystem diagnostics D44 and DTC.

This activity is intended for the student who will maintain 844 equipment on the 7155 controller.

Locate the MALET documentation (53140094) microfiche labelled D44 and DTC and read them.

Additional procedural information will be provided during the laboratory exercise.

CYBER Fixed Module Drive
Learning Activity 5-0

LEARNING ACTIVITY 5-0. TEXT READING: FMD-HPA DESCRIPTION

This activity describes three types of HPA reports as they apply to the FMD subsystem.

OBJECTIVE

- You will be able to recognize three types of CDC CYBER fixed module drive (FMD) HPA reports and describe their purpose.

The hardware performance analyzer (HPA) program is used to monitor the performance of FMD equipment on the 6000, CDC CYBER 7X, and CDC CYBER 17X computer systems.

The HPA reports are obtained from the ERRLOG, which interfaces with NOS, and CERFILE, which interfaces NOS/BE. Using the information provided by various reports, you can identify failing or deteriorating equipment and take necessary action to correct the problem.

These reports include FMD subsystem error information. They are the summary report (see figure 5-20), detailed report (see figure 5-21), and unit analysis report (see figure 5-22).

HPA V4.0/E2G SUMMARY ... ERROR LOG ENTRIES 80/01/31. 13.51.01.					
* * * * *					
EQUIP	MESSAGE	DATE	TIME/FIRST--LAST	TOTAL	
DQ 001	DISK PACK S/N MESSAGE ENTRY	01/25/80	07.19.39--22.15.51	8	
DQ 002	CHECKWORD ERROR	01/25/80	16.07.27--21.06.55	3	
DQ 002	DISK PACK S/N MESSAGE ENTRY	01/25/80	07.19.40--22.15.51	8	
DQ 012	DISK PACK S/N MESSAGE ENTRY	01/25/80	07.19.40--22.15.52	8	
DQ 013	DISK PACK S/N MESSAGE ENTRY	01/25/80	07.19.40--22.15.52	8	

Figure 5-20. Summary Report

CYBER Fixed Module Drive
Learning Activity 5-0

The first report is the summary report. This report provides a complete list of errors for the entire system. Figure 5-20 shows only the entries for the FMD equipment. The summary report includes the following information.

- EQUIP. The DQ entry tells you it is a full track FMD device. The second column is the EST ordinals 1, 2, 12, and 13.
- MESSAGE. Type of errors detected or error messages. The messages show a disk pack S/N message entry or checkword error.
- DATE. Day on which errors occurred, 1/25/80.
- TIME. First and last time in hours, minutes, and seconds that the error occurred.
- Total the number of times each error occurred is shown in the last column in figure 5-20.

The second report is the detailed report. Figure 5-21 is a detailed report on the checkword error shown in the summary report.

CYBER Fixed Module Drive
Learning Activity 5-0

The DEVICE/EST line tells you the device type DQ and EST ordinal 002. The controller line tells you it's a 7155 controller, equipment number 00, FMD device unit number 043, and MSG (message) type = checkword error.

The columns give you the following information.

- The date (1/25/80) and time of each checkword error is given as hour, minute, and second.
- The job name and the serial number, pack-ID, of the disk pack in use at the time the error was detected are given.
- The RCV column indicates by yes or no if the subsystem recovered or didn't recover from the error condition.
- The RTY-CNT (retry count) column indicates the number of attempts made to recover from the error.
- The R/W (read/write) column indicates by an R or W the active operation when the error was detected.
- The CHAN and FCN columns give the CHAN number and last function issued.
- The CYL/TRACK/SEC columns give the cylinder, track, and sector number where the checkword error occurred.
- The GEN STAT column gives the 12-bit general status word obtained from the 7155 controller.
- The 10 detailed columns lists, in 2 lines, a maximum of 20 words of extended detailed status.

CYBER Fixed Module Drive
Learning Activity 5-0

HPA V4.0/R2G... DETAIL REPORT.. MASS STORAGE 80/01/31. 13.51.01.

DEVICE/FST - ** DC CC2 ** .. 844/FMD DATA ..

CONTROLLER 7155 EQLIF 00 UNIT 043 MSG-TYPE >>> CHECKWORD ERROR <<<

DATE	TIME	JOB	PACK-ID	RCV CNT	RTY	R/W	CHAN	ECN	CYL/	TRACK/	SEC	STAT	GEN
01/25/80	16.07.27	ALCY044T	000221	YES	01	R	05	000	0054	007	006	46C0	
	21.00.44	DISOADS	000221	YES	01	W	07	000	0054	007	006	46C0	
	21.06.55	DISOADS	000221	YES	01	W	07	000	0054	007	006	46C0	

DETAIL STATUS

1	2	3	4	5	6	7	8	9	10
20/6340/	100/6243/6000/	/	10/3037/3740/7001						
/	/2000/	/	/ 200/	25/	412/	100/2004			
20/6340/	720/6243/4600/	/	10/3037/3700/7201						
/	/2000/	/	/ 210/	101/	412/	241/6405			
20/6340/	120/6243/ 540/	/	10/3037/3700/7201						
/	/2000/	/	/ 210/	101/	412/	240/2405			

Figure 5-21. Detailed Report

CYBER Fixed Module Drive
Learning Activity 5-0

The third type of report is the unit analysis report. Figure 5-22 is a unit analysis report on the device at EST ordinal 02 in the summary report.

HPA V4.0/R2G		UNIT ANALYSIS REPORT		80/01/31. 13.51.01.	

DT-FST	CH-EQ-UN	DATE			
DQ 002	05 00 03	01/25/80			

>>>> MESSAGE DISTRIBUTION <<<<					
MESSAGE	TIME - HOURS				
-----	00-----04-----08-----12-----16-----20-----24	TOTALS			
	/ / / / / / /				
CHECKWORD ERROR	/ / / / / 1 / 2 / 3				
DISK PACK S/N .. 000221	/ / 2 / / 2 / 2 / 2 / 8				
	-----	-----			
TOTALS	/ / 2 / / 2 / 3 / 4 / 11				
... POSITION ANALYSIS SUMMARY ...					
CYLINDER	CTY	TRACK	CTY	SECTOR	CTY
0054	3	07	3	006	3

Figure 5-22. Unit Analysis Report

The unit analysis report contains error information grouped by time of day the error occurred, message distribution and number of errors by address location.

The information across the top is DT-EST, which is device type DQ and EST ordinal 002. The CH-EQ-UN indicates channel five, equipment number 0, and unit 3. The date is 1/25/80.

The message distribution area shows error messages and the time's, in the 24-hour day, that the error occurred. Note the 24-hour day is divided into 4-hour increments.

CYBER Fixed Module Drive
Learning Activity 5-0

The position analysis summary areas lists QTY, quantity, of errors at the cylinder and track and sector address location. Figure 5-22 shows the three checkword errors all occurred at cylinder 54, track 7, sector 6.

The reports just described are HPA reports that can be requested for the FMD subsystem. Refer to the 7155 Troubleshooting Guide, section 1, for an example of an FMD subsystem intervention report.

This concludes learning activity 5-0. You may review the reports before going on to the next activity.

CYBER Fixed Module Drive
Learning Activity 5-P

LEARNING ACTIVITY 5-P. EXERCISE: FMD-HPA REVIEW

This activity reviews the FMD-HPA reports.

OBJECTIVE

- You will be able to recognize three types of CDC CYBER fixed module drive (FMD) HDA reports and describe their purpose.

After completing the exercise, check your answers with those given at the end of this learning activity.

Directions: After reading each of the following statements, fill in the blank(s) with a word or words to complete the statement and make it true. Refer to figure 5-20.

1. The device type for a full track FMD is indicated in the summary report by DOQ.
2. The time of the first checkword error was 16.07.27.
3. The EST ordinal of the device causing the checkword error is 02.
4. The time of the last disk pack S/N message entry was 22.15.52 on January 25 1980.
5. There was a total of 3 checkword errors.

Directions: After reading the following statements, fill in the blanks with a word or words to complete this statement and make it true. For questions 6 through 11, see figure 5-21. For questions 12 through 15, refer to figure 5-22.

6. The detailed report is for the checkword error on disk unit number 43.
7. For the checkword error occurring at 16.07.27, detailed status word 1 indicates the retry count is 1.
8. The serial number of the pack with the checkword error is 000 221.
9. The checkword errors all occurred at cylinder 54, track 07 and sector 06.

CYBER Fixed Module Drive
Learning Activity 5-P

10. The general status word decodes as abnormal term; recovery in progress and checkword error.
11. The errors during the DISOADWS jobs occurred during a write (read/write) operation.
12. The position analysis summary shows 3 errors occurring, at cylinder 54 track 07 and sector 06.
13. There was a total of 8 disk pack S/N messages.
14. A total of 0 messages occurred between 8 a.m. and noon.
15. A total of 4 messages occurred between 8 p.m. and midnight.

CYBER Fixed Module Drive
Learning Activity 5-P

ANSWERS TO LEARNING ACTIVITY 5-P

1. DQ
2. 16.07.27
3. 002
4. 22.15.52, 25
5. three
6. three (the four of 043 indicates FMD device)
7. one
8. 000221
9. 54, 7, 6
10. abnormal termination, recovery in process, and checkword error
11. write
12. three, 54, 7, 6
13. eight
14. zero
15. four

POST TEST

When you have completed the learning activities assigned for module 5, sign on to the PLATO terminal and take the module 5 test.

You may use your student manual and your reference manuals during the test. Be sure to take them with you to the PLATO terminal.

Depending on the results of the test, you will be told either to review some of the activities in this module or to go on to module 6.

MODULE 6

FMD TROUBLESHOOTING SIMULATION I

This module enables you to learn the techniques used in trouble shooting the CYBER FMD Subsystem. You will trouble shoot simulated problems in the hardware using a PLATO troubleshooting simulator.

PRETEST

There is no pretest or post test for this module. Mastery is awarded when all of the simulations required by PLATO learning management (PLM) are completed.

LEARNING ACTIVITIES

All simulations for this module are presented within one learning activity. As simulations are finished, PLM will indicate completion and log the number you have completed. All simulations must be completed in order to achieve mastery for this module.

<u>Activity</u>	<u>Description</u>	<u>Page</u>
6-A	PLATO: PLATO Troubleshooting Simulation. During this activity you will troubleshoot simulated hardware problems using a PLATO troubleshooting simulator.	6-2

CYBER Fixed Module Drive
Learning Activity 6-A

LEARNING ACTIVITY 6-A. PLATO: PLATO TROUBLESHOOTING SIMULATION

In this activity you will trouble shoot simulated hardware malfunctions using a PLATO troubleshooting simulator.

OBJECTIVE

- You will be able to isolate and correct simulated malfunctions in the CYBER FMD Subsystem using a PLATO troubleshooting simulator.

DIRECTIONS

Sign on to the PLATO terminal. If this is your first experience with the troubleshooting simulator or you would like a review of its use, take the module introductory lesson. If you do not take the module introductory lesson, you may begin your first simulation.

MODULE 7

FMD SUBSYSTEM LABORATORY

During this module, you will run and interpret the subsystem diagnostics and troubleshoot instructor-induced failures. You will also locate subsystem components and perform specified mechanical and electrical tasks.

Directions: This module requires an instructor and laboratory equipment for all learning activities. Approximately 16 hours should be allowed for the laboratory activities. Contact your course administrator to schedule lab. You will work in a group of no more than three students. Read and observe the safety practices on the following pages and read through the procedures of each learning activity. In the procedures portion of each learning activity are instructor checkpoints. Ask your instructor to initial all checkpoints as you complete the procedures. When you have completed all the procedures in a learning activity, ask your instructor to initial the learning activity instructor checkpoint on the module title page.

Because this module uses a laboratory instructor to verify your activities, there is no test on the objectives.

At the end of the module is an instructor confirmation page. When you have completed all learning activities, ask your instructor to sign the instructor confirmation form.

The signed instructor confirmation form should then be removed from the student manual, folded, stapled, and mailed. Notice that the address and postage are already printed on the back of the confirmation form. When the form is received by Engineering Services Education (ESE), the ESE administrator will record your successful completion of module 7.

LEARNING ACTIVITIES

You must complete the required learning activities. At the completion of each activity, ask your instructor to initial the instructor checkpoint.

CYBER Fixed Module Drive
Module 7

<u>Instructor</u>	<u>Checkpoint</u>	<u>Activity</u>	<u>Description</u>	<u>Page</u>
_____	_____	7-A	Laboratory: Mechanics. During this activity, you will locate the specified 885 and 7155 components, perform PM tasks, and remove/replace the HDA.	7-7
_____	_____	7-B	Laboratory: Diagnostic Execution On-Line. During this activity, you will load and run the FMD subsystem diagnostics on-line.	7-15
_____	_____	7-C	Laboratory: Diagnostic Execution Off-Line. During this activity, you will load and run the FMD subsystem diagnostics off-line.	7-25
_____	_____	7-D	Laboratory: Electrical. During this activity, you will perform 885 and 7155 voltage checks and adjustments and the 885 servo adjustment.	7-34
_____	_____	7-E	Laboratory: Fault Isolation. During this activity, you will troubleshoot the CDC CYBER FMD subsystem by using the diagnostic error messages and troubleshooting guide to perform corrective action.	7-37

SAFETY PRACTICES

All engineers are expected to follow reasonable and appropriate precautions with respect to electrical, mechanical, and personal safety hazards while working on computer system equipment. Note the entries in the maintenance documentation labelled DANGER or WARNING that identify hazardous areas or procedures encountered in maintaining the system equipment. The following additional procedures should be followed when working on equipment.

Personal

1. Ensure that none of your actions cause unsafe conditions that may expose customer personnel to hazards in any device.
2. Never work alone on equipment that has exposed operating mechanical parts or exposed hazardous power components. If you must do so, notify your EIC or manager. In any case, the following precautions must be observed.
 - a. Someone familiar with the power-off controls must be in the immediate area.
 - b. Personal jewelry (rings, wristwatches, bracelets, necklaces, etc.) must be removed. A small box in the CE tool kit will make a good storage place for these items.
 - c. When using only one hand, keep the other hand in your pocket.
 - d. Avoid wearing loose articles of clothing that can be snagged and drawn into moving machinery. Wear short-sleeve shirts or roll sleeves above the elbow. Neckties, where required, should be tucked in between the second and third shirt button or fastened about 3 inches from the end with a tioletack or tieclasp, preferably nonconductive. Clip-on neckties are preferable to the regular ones; if caught they will pull free without causing injury.
 - e. Before starting equipment, make sure that no CE or customer personnel are in a position where they could get hurt.
 - f. While working in equipment, put red tape strips across any power controls, or use DO NOT OPERATE tags where available.

CYBER Fixed Module Drive Safety Practices

3. Keep CE tool kits out of walkways; put them on or under a desk or table.
4. Put doors and covers that you remove from a machine in a safe, out-of-the-way location where no one will trip over them or cause them to fall and injure another person. All machine covers must be in place before the machine is returned to the customer.
5. All safety covers, guards, shields, groundstraps, panels, etc. must be properly reinstalled after maintenance is finished.
6. Maintain good housekeeping practices during and following each maintenance activity. Do not permit tools, manuals, wipers, paper, or trash to accumulate in the work area; clean up after yourself.

Electrical

1. Shut off All AC and DC power when removing or installing major assemblies, working inside power supplies or power control enclosures, performing detailed mechanical maintenance procedures, or wiring and/or changing modules in the machine. If possible, turn off and lock or tag the circuit breaker in the service panel on the wall; unplug the main power supply cord.
2. Use only well-insulated pliers, screwdrivers, test leads, etc. when working on or near live circuits.
3. Do not disconnect or disable safety grounding systems even if the equipment is powered off. These are installed for your protection.
4. Avoid touching grounds, such as equipment frames, metal floor tile edgings, and electrical conduits. If possible, purchase rubber or vinyl mats.

Mechanical

1. Do not use chemicals, grease, oil, or solvents that have not been specifically approved by the equipment manufacturer for that device. Their recommendations are usually based on extensive experience with the equipment in service.
2. Use the proper tools for the job. Improper use of tools can result in personal injury or equipment damage.
3. Immediately replace worn or broken tools and test equipment.

CYBER Fixed Module Drive
Safety Practices

4. If the machine is running, do not reach in to the works; remember, they are your fingers and you only get one set per lifetime.
5. If using a strobelight on mechanical devices, don't touch the equipment because it may be moving.
6. Safety glasses or goggles must be used if you are--
 - a. Driving pins, riveting, swaging, or similar activities.
 - b. Using an electric drill, grinder, reamer, etc.
 - c. Installing or removing springs under tension or compression.
 - d. Using any type of solvent, spray, or chemical for cleaning or touch-up painting.
 - e. Engaged in any other activity that may endanger the eyes. They are your eyes, and you need them for this type of work.
7. When lifting, use a method that will not injure the spine or strain back muscles. Be realistic about your capacity for lifting.
8. Use good judgement and common sense. A moment of thought before you act can save hours of agonizing afterthought.

LEARNING ACTIVITY 7-A. LABORATORY: MECHANICS

During this activity, you will locate the specified 885 and 7155 components, perform PM tasks, and remove and replace the HDA.

OBJECTIVE

- You will be able to locate all specified components and perform specified mechanical maintenance tasks on the CDC CYBER FMD subsystem.

REFERENCE MATERIALS

<u>Title</u>	<u>Publication Number</u>
FMD Controller Manual	GF60455690
BZ703 CYBER Disk Storage Theory of Operation Manual	83322880
BZ703 CYBER Disk Storage Manual, Volume 1	GF83322860
7155 Troubleshooting Guide	60456010

EQUIPMENT/TOOLS

The following tools are necessary for this learning activity.

- Standard site tools.
- FMD maintenance tools and materials as listed in table 2-1 of the BZ703 CYBER Disk Storage Manual, Volume 1.
- Controller maintenance tools as listed in the FMD Controller Manual.
- 855 (BZ703) Fixed Module Drive.
- 7155 (FA211) controller.
- Microfiche viewer.

CYBER Fixed Module Drive
Learning Activity 7-A

PROCEDURES

To complete this learning activity, perform the following procedures.

1. Your instructor will direct you to the equipment used during this learning activity.
2. Locate the following 7155 controller components.

NOTE

Refer to the 7155 Troubleshooting Guide, section 2, for physical location illustration. Observe procedures to remove/replace components of the 7155 power supplies, air circulation system, switches, and indicators.

- ☒ Logic chassis row A and row B
- ☒ 60-pak logic boards and board location numbering
- ☒ Wire-wrapped back panel and pin numbering
- ☒ -2.2-volt bus bar
- ☒ -5.2-volt bus bar
- ☒ Logic board switches and LEDs
 - ☒ Parity enable switch
 - ☒ Open cable/power loss detect switch
 - ☒ Connected channel LEDs
 - ☒ Autoload LED
 - ☒ Deadman timer LED
 - ☒ PP channel parity error LED
 - ☒ Processor output channel LEDs
 - ☒ Processor channel flag LEDs
 - ☒ Processor channel select LEDs
 - ☒ Control memory parity error LED
 - ☒ A register LEDs

CYBER Fixed Module Drive
Learning Activity 7-A

- ☒ P register LEDs
- ☒ ROM and RAM parity error LEDs
- ☒ Equipment Ident. No. switches (FA211 B/C models) A07

Power, supplies

- ☒ -2.2-volt supply, C.B., and adjust
- ☒ -5.2-volt master supply, C.B., and adjust
- ☒ -5.2-volt slave supply and C.B. (not present in newer controllers)
- ☒ Meter
- ☒ 400-Hz power disconnect C.B.
- ☒ 60-Hz power disconnect toggle switch
- ☒ 50/60-Hz outlet
- ☒ 50/60-Hz and 400-Hz input cables
- ☒ Relay K1
- ☒ Relay K3
- ☒ Air filter and blower

Air flow sensor

- ☒ Relay indicator
- ☒ Off blower switch
- ☒ Power on indicator

Switch panel

- ☒ Master clear P.B.
- ☒ 885 drive enable/disable switches
- ☒ 844 drive enable/disable switches
- ☒ PP channel enable/disable switches

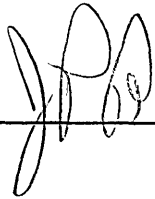
PP I/O connector panel

CYBER Fixed Module Drive
Learning Activity 7-A

- ☒ 885 connector panel
- ☒ 844 connector panel
- ☒ Grid ground connector
- ☐ 885 power sequence interface panel
 - ☒ Power sequence relays
 - ☒ Master slave switch
 - ☒ Power sequence cable connectors
- ☒ Equipment identification name plate

3. Perform the PM tasks under cleaning and cooling and mechanical inspection as described in section 6 of the FMD Controller Manual.

Instructor Checkpoint



4. Read the Safety Precautions and Handling Electrostatic Devices in section 2A of the BZ703 CYBER Disk Storage Manual, volume 1.
5. Locate the following CDC CYBER FMD components.

NOTE

Refer to the 7155 Troubleshooting Guide, section 3, or the BZ703 CYBER Disk Storage Manual, volume 1 section 2A, for physical location illustrations.

- ☒ Front doors
- ☒ Side panels
- ☒ Rear doors
- ☒ Rear top cover
- ☒ Front top cover

CYBER Fixed Module Drive
Learning Activity 7-A

- ☒ Operator panels for device A and device B
 - ☒ Channel I, II enable switch/indicators
 - ☒ I, II RSVD indicators
 - ☒ System maintenance switch/indicator
 - ☒ Selected and RSVD indicator
 - ☒ Read only switch/indicator
 - ☒ Ready indicator
 - ☒ Start switch/indicator
- ☒ Power control panel
 - ☒ Power-on switch/indicator
 - ☒ Power enable/switch/indicator
- ☒ Maintenance panel
 - ☒ Local remote switch
 - ☒ Fault lights
 - ☒ Positioner lights
- ☒ CE Rezero switch
- ☒ Drive motor and brake
- ☒ 60-Hz Drive motor reset button
- ☒ Blower motor
- ☒ High-pressure blower
- ☒ Low-pressure blower
- ☒ Air Filters
 - ☒ Course
 - ☒ Prefilter
 - ☒ Absolute filter

CYBER Fixed Module Drive
Learning Activity 7-A

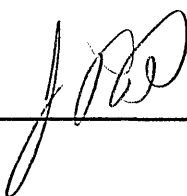
- ☒ Air pressure switch for device A and device B
- ☒ Logic chassis door
- ☒ Logic boards for device A and device B
- ☒ Wire-wrapped back panel and pin numbering
- ☒ Unique ID switches (board location 20)
- ☒ HDA (head disk assembly)
- ☒ Magnet
- ☒ Read/write matrix logic boards
- ☒ Servo cable (P12)
- ☒ Voice coil leads
- ☒ DC power supply
 - ☒ Circuit breakers
 - ☒ Device DC power switch
 - ☒ Device A and device B $\pm$ 5 volt regulator boards and adjusts: A3A1, A3A2
 - ☒ Device A and B power amps A3A3, A3A4
 - ☒ A4 compartment
- ☒ AC power distribution unit and all circuit breakers
 - ☒ Blower relay A2K1
 - ☒ Enable drive motor relay A2K2
 - ☒ Drive motor A relay A2A1K3
 - ☒ Drive motor B relay A2A1K4
 - ☒ Phase O.K. relay A2K5
 - ☒ A17 compartment
- ☒ Unit power sequence board
 - ☒ Drive motor run, device B, relay A6K1

CYBER Fixed Module Drive
Learning Activity 7-A

- ☒ Allow start relay A6K2
- ☒ Frame sequence delay relay A6K3
- ☒ +5 volt sense relay A6K4
- ☒ HDA sequence complete, device B, relay A6K5
- ☒ Device sequence complete relay A6K6
- ☒ Start devices relay A6K7
- ☒ HDA sequence complete, device A, relay A6K8
- ☒ Drive motor run, device A, relay A6K9
- ☒ String power sequence board
 - ☒ (K501) transfer pick relay A5K01
 - ☒ (K502) +24V frame sequence relay A5K02
- ☒ Equipment identification name plate
- ☒ Grid ground connectors
- ☒ 50/60 Hz input cable and connections
- ☒ 400 Hz input cable and connections
- ☒ Remote sequencing cable connectors
- ☒ Controller interface cable connectors for device A and device B

6. Perform the PM tasks as described in the BZ703 CYBER Disk Storage Manual, volume 1, section 2B.

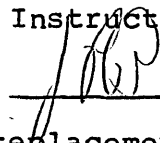
Instructor Checkpoint _____



CYBER Fixed Module Drive
Learning Activity 7-A

7. Perform HDA removal and replacement as described in the BZ703 CYBER Disk Storage Manual, volume 1, section 2D. Your instructor will direct you using this procedure.

Instructor Checkpoint

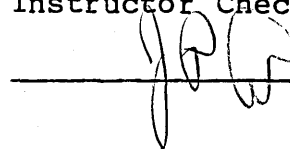


8. Go over the following removal and replacement procedures as described in the BZ703 CYBER Disk Storage Manual, volume 1, section 2D. Although you will not be required to perform all procedures, observe all steps and components to ensure you will be able to perform the tasks when necessary. Your instructor will direct you.

- ☒ Power Distribution Unit
- ☒ Air Filter Replacement
- ☒ Blower Motor Assembly Replacement
- ☒ Power Supply Replacement
- ☒ Drive Motor and Brake Assembly Replacement
- ☒ Drive Motor Belt Replacement
- ☒ Drive Motor Pully Replacement
- ☒ HDA Voice Coil Replacement
- ☒ Logic Chassis Wirewrap Replacement
- ☒ Logic Card Replacement
- ☒ Backpanel Wirewrap Pin Straightening and Replacement

Observe what is necessary to remove/replace all switches, indicators, HDA pressure sensor switch, logic chassis temp sensor, Unit and String Power Sequence Boards and their relays, and the major components of the power supplies.

Instructor Checkpoint



CYBER Fixed Module Drive
Learning Activity 7-A

9. Go over the 7155 controller Bellows Contact and Wirewrap Post removal/replacement as described in section 6 of the FMD Controller manual.

Instructor Checkpoint _____

NOTE:

Ask your instructor to initial the module title page for Learning Activity 7-A.

LEARNING ACTIVITY 7-B. LABORATORY: DIAGNOSTIC EXECUTION ON-LINE

During this activity you will load and run the FMD subsystem diagnostics on-line.

OBJECTIVE

- You will be able to load and run the diagnostics FMC, FMD, D88 and the utility FMU on-line.

REFERENCE MATERIALS

<u>Title</u>	<u>Publication Number</u>
7155 Troubleshooting Guide	60456010
Operator Troubleshooting/Maintenance Guide	60456650
MALET Documentation	53140094
CML Version 3 Reference Manual	60455980
MALET Reference Manual	60456020

EQUIPMENT/TOOLS

The following tools are necessary for this learning activity.

- Standard site tools
- 855 (BZ703) Fixed Module Drive.
- 7155 (FA211) controller.
- 844-4X (BR308/BR312) Disk Unit.
- 6000, or CDC CYBER 7X, or CDC CYBER 17X computer.
- Operating system with CML installed containing all FMD diagnostics.
- Microfiche viewer.

CYBER Fixed Module Drive
Learning Activity 7-B

Before running the FMD subsystem diagnostics, it is important to understand Access Levels and their effect on the operating system and any customer data that may be on the pack. Before any MALET modules are allowed to execute, a program called CEVAL validates all data supplied by the assigned directive. One of the things checked is access level. If no access level is defined, default = 1. The Disk access levels are as follows:

- 1 = Read Pre-allocated area.
- 2 = Read any normal data area only.
- 3 = Read any normal data area, write pre-allocated area only.
- 4 = Read/Write any normal data area, dedicated unit.
- 10 = Dedicated controller and all units.
- 20 = Dedicated controller, all units, and channels.
- 21 = Same as 20, plus Channel may be left in hung state.

An access level of 1 through 3 normally will have no adverse effect on customer operation. A test with an access level of 4 may destroy any customer data on the pack and require a dedicated unit. An access level of 10 or higher is even more restrictive to customer operation as they require a dedicated controller as well as all units.

NOTE:

Be sure to check CEVAL validation criteria at your site for any unique restrictive conditions.

The 7155 Troubleshooting Guide recommends access level 3 for FMD, access level 3 for D88, access level 10 for FMC and access levels 3 and 4 for FMU.

Instructor Checkpoint _____

CYBER Fixed Module Drive
Learning Activity 7-B

PROCEDURES

To complete this learning activity, perform the following procedures.

1. You will be required to run the FMD subsystem diagnostics, FMC, D88, FMD and the utility program FMU. If you are responsible for maintaining 844s, you will also run D44 and DTC. You will be required to run the diagnostics on-line (CML) from the remote terminal and system console, and/or cards-batch deck, depending on the availability of equipment. Your instructor will specify the procedure(s) to use as you run and interpret the FMD subsystem diagnostics.

Procedures 4 through 9 guide you through running FMC, D88, FMD, FMU, D44, and DTC.

Before the diagnostics can be run, they must be installed. The following steps may be used to install and checkout an FMD subsystem. Your instructor will direct you if it is necessary to perform these steps at your laboratory site.

- a. Perform procedure 1-1, diagnostic installation, in the 7155 Troubleshooting Guide. This procedure will store all the diagnostics, controlware, and 885 diagnostic patterns. If a card reader is not available to store MA721 controlware, the site analyst may be able to strip a copy off the operating system and store it as a permanent file. Procedure 1-1C, steps 1, 2, and 3 should be repeated to store controlware to the 885 spindles with the run command changed to R,FMU(21).
- b. Once the diagnostics are installed under CML and the controlware is written out to cylinder 1511 of the 885 along with the 885 diagnostic patterns, you are ready to run diagnostics on the subsystem.
- c. Execute FMC, FMD, and D88 in this order according to the instructions given in the 7155 Troubleshooting Guide.
- d. If all diagnostics execute properly without error, perform procedure 2-1, archiving MAPS, in the Operator Troubleshooting Guide.
- e. Repeat steps b through d until all spindles are checked out. This completes your FMD installation.

2. Your instructor will direct you to the equipment for this activity.

NOTE

Make sure the disk unit is powered up and ready. Power on and press the master clear switch in the upper right-hand corner of the controller. The P register LEDs should now read 21BF, 20677 octal (see figure 2-1 in the 7155 Troubleshooting Guide). If the P register does not read 21BF, go to the controller isolation/correction procedure (table 2-1 in the 7155 Troubleshooting Guide) and follow the instructions. If the P register does read 21BF, enable the proper switches on the controller switch panel for the channel accesses and the drive ports (see figure 1-3 in the 7155 Troubleshooting Guide). At this time, the maintenance switch and the channel enable switches on the 885 drives should be pressed. Remember, there are six switches, three for each spindle.

3. Run the diagnostics on-line. Your instructor will specify if you are to run the diagnostics from the sytem console, cards, and/or a remote terminal. Refer to the 7155 Troubleshooting Guide and the Operator Troubleshooting Guide for the loading and running procedure. Your instructor will provide unique directions for deadstarting and calling the tests on your laboratory site. You may refer to the MALET Reference Manual and the CML Version 3 Reference Manual for additional information.
4. Run the FMC diagnostic.
 - a. Your instructor will specifiy the method(s) to use to run the test. Refer to the MALET (FMC) documentation.
 - b. What is the channel number(s) for 7155 controller to be tested?

CYBER Fixed Module Drive
Learning Activity 7-B

- c. What is the device number for the FMD to be tested?

NOTE

Modules 0 and 1 don't need controlware, modules 2 and 31 load controlware, all other modules require controlware. To run module 2, the controlware must be attached as a scratch file. To run module 31, the controlware must be on the disk. FMU module 21 copies the controlware to the disk.

- d. The 7155 Troubleshooting Guide tells you to set P4 to 4000 and P5 to 1010.
- e. Run FMC modules 0 through 33.

NOTE

If any error occurs, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

- f. What is the last module in the test series?

33

- g. What is the name of module 35?

- h. What is the module number of the LED test?

NOTE

Your instructor will specify if you are to run module 35 and the LED test.

Instructor Checkpoint _____

5. Run the D88 diagnostic.

- a. Your instructor will specify the method(s) to use to run the test. Refer to the MALET (D88) documentation.
- b. Run the confidence/verification modules.

NOTE

If any error occurs, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

- c. What is the number of the last confidence/verification module?
- d. Run the parameter driven modules. Your instructor will specify the area of the disk to be tested.

NOTE

These modules write on the disk: make sure customer data is not destroyed.

CYBER Fixed Module Drive
Learning Activity 7-B

- e. What cylinder(s), track(s) and sector(s) did you test?

Instructor Checkpoint _____

6. Run the FMD diagnostic.

- a. Your instructor will specify the method(s) to use to run the test. Refer to the MALET (FMD) documentation.
- b. P4 set to 4000 and P5 set to 10 enables _____ and disables operator _____.

NOTE

To run all modules, cylinder 841 must first be written by FMU module 23, write diagnostic tracks.

- c. Run FMD modules 0 through 70.

NOTE

If any error occurs, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

- d. What is the last module in the test series?
- e. What modules were not ran in the test series?

- f. Your instructor will specify if you are to run the remaining modules.

Instructor Checkpoint _____

7. Run the FMU utility.

- a. Your instructor will specify the method(s) to run the utility. Refer to the MALET (FMU) documentation, and section 2, Flaw Maintenance, of the Operator Troubleshooting Guide.
- b. Run modules 01, 02 and 03 to obtain a printout of the pack serial number, factory, map and utility map.
- c. Run modules 05 and 06 to set and clear a flaw bit.

NOTE

FMU flaws by physical sector number. Operating systems identify sectors by logical number. Modules that write on the pack, pause after the run directive and must be given a go.

- d. At what cylinder, track, and sector did you set and clear the flaw bit?
- e. Run module 11 or 12 to format the pack. Your instructor will specify which format operation to perform.

NOTE

Formatting will destroy any customer data in the area that is formatted.

- f. What area of the disk pack did you format?

CYBER Fixed Module Drive
Learning Activity 7-B

- g. Your instructor will specify if you are to run module 14-format utility track.

NOTE

Formatting will destroy existing utility map. Make sure the utility map has been archived.

- h. What is the purpose of parameters 8 and 9 when using module 14.

- i. What is the purpose of modules 15 and 16?

- j. Run modules 15 and 16.
- k. Use procedure 2-1 in the Operator Troubleshooting Guide to archive the maps.
- l. Use procedure 2-2 in the Operator Troubleshooting Guide to restore the maps.
- m. Run module 21 to copy controlware to the 885.

NOTE

Cylinder 841 track 2 must first be track flawed. (three flawed sectors). Also, attach the MA721 controlware.

- n. Run modules 22 and 23.
- o. What is the revision level of the controlware?

- p. At what cylinder and tracks are the diagnostic patterns written?

Instructor Checkpoint _____

- 8. Run the D44 diagnostic (optional).
 - a. Install a scratch disk pack on the unit to be tested.
 - b. Your instructor will specify the method(s) to use to run the test. Refer to the MALET D44 documentation.
 - c. What is the unit number of the disk drive to be tested?
 - d. Run the confidence level modules.

NOTE

If any error occurs, look up the error code and interpret the message. Your instructor will direct you if maintenance procedure is required.

- e. Run the individual selectable modules.
 - f. What is the number of the last individual selectable modules?

Instructor Checkpoint _____

- 9. Run the diagnostics DTC (optional).
 - a. Install a scratch disk pack on the unit to be tested.
 - b. Your instructor will specify the method(s) to use to run the test. Refer to the MALET DTC documentation.
 - c. Run modules 0 through 19.

CYBER Fixed Module Drive
Learning Activity 7-B

NOTE

If any error occurs, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required. Your instructor will specify if you are to run module 20, the dual access test.

Instructor Checkpoint _____

10. Diagnostic documentation.

- a. Your instructor will direct you to the procedure to obtain a printout of the FMD diagnostics External and/or Internal documentation.

Instructor Checkpoint _____

NOTE

Ask your instructor to initial the module title page for Learning Activity 7-B.

LEARNING ACTIVITY 7-C. LABORATORY: DIAGNOSTIC EXECUTION OFF-LINE

During this activity you will load and run the FMD subsystem diagnostics off-line.

OBJECTIVE

- You will be able to load and run the diagnostics FMC, FMD, D88 and the utility FMU off-line.

REFERENCE MATERIALS

<u>Title</u>	<u>Publication Number</u>
7155 Troubleshooting Guide	60456010
Operator Troubleshooting/Maintenance Guide	60456650
MALET Documentation	53140094
SMM Reference Manual	60160600
MSL Reference Manual	60455770

EQUIPMENT/TOOLS

The following tools are necessary for this learning activity.

- Standard site tools
- 855 (BZ703) Fixed Module Drive.
- 7155 (FA211) controller.
- 844-4X (BR308/BR312) Disk Unit.
- 6000, or CDC CYBER 7X, or CDC CYBER 17X computer.
- Off-line maintenance system library (CMSE) with DEMOT.
- SMM with MALET Diagnostics.
- Microfiche viewer.

CYBER Fixed Module Drive
Learning Activity 7-C

SMM PROCEDURES

To complete this learning activity, perform the following procedures.

1. You will be required to go through the steps to checkout the FMD subsystem using the off-line SMM MALET diagnostics FMC, D88, FMD, and the utility program FMU. If you are responsible for maintaining 844s, you will also run D44 and DTC.
2. Your instructor will direct you to the equipment to be used during this activity.
3. Power up the disk drives to be used. Ensure the Ready light is on. Check the drives operator panel to ensure the proper Channel Enable switches are depressed and the System Maintenance switch is depressed. Power on and press the master clear switch in the upper right-hand corner of the controller. The P register LEDs should now read 21BF hex (20677 octal). Refer to figures 2-1A or 2-1B in the 7155 Troubleshooting Guide. If the P register does not read 21BF go to table 2-1 in the 7155 Troubleshooting Guide and follow the instructions. If the P register does equal 21BF set PP Channel and 8XX Drive switch on controller switch panel to enable for PP channel and drive to be used.

CYBER Fixed Module Drive
Learning Activity 7-C

4. Perform steps 1 through 6 of procedure 1-8D in the 7155 Troubleshooting Guide (Rev. D or later). Your instructor will direct you if SMM is to be transferred to disk or not.
 - a. After you have performed step 6, SMM is in AUTO mode.

Instructor Checkpoint

5. Perform steps 7 through 9 of procedure 1-8D in the 7155 Troubleshooting Guide (Rev. D or later). Your instructor will direct you as to the method of loading controlware.
 - a. The 7155 controller you will test is on channel 04 and the disk is unit 40. Refer to the SMM Reference Manual and the section titled SMM MALET DIAGNOSTICS for information on SMM MALET.
6. Store controlware out on cylinder 1511 of the 885 spindle assigned in procedure 5, Type:

```
PARAM, P1=1511, P2=2, P3=XX
(where XX=37, 40, 41)
RUN, FMU (05)
Go
```

Repeat the preceding commands three times with a new value for XX each time. This will set a track flaw. Only three sector flaws are allowed on this track.

CYBER Fixed Module Drive
Learning Activity 7-C

After a total of three sector flaws have been set, type:

PRAM, P1=0, P2=0, P3=0
RUN, FMU (21)

Instructor Checkpoint PPD

7. Write the diagnostic patterns out to the 885 spindle assigned in procedure 5, Type:

RUN, FME (23)
GO

8. Refer to procedure 1-6C in the 7155 Troubleshooting Guide (Rev. D or later) and perform steps 1 and 2.

a. What diagnostic does procedure 1-6C direct you to Run?

b. What value is used for parameters P4 and P5?
FMC

c. With the suggested parameter setting, will the Controlware be reloaded when the diagnostic is run?
P4=4000 P5=1010

d. What module loads the controlware from the disk?
NO
FMC02

e. For Module 2 to load controlware, the controlware must be attached as a scratch file. What command is used, under SMM, to attach the scratch file with MA721 controlware?

f. For Module 2 to load controlware, what value should be in parameter 5?
scratch-FMCCW

P5=0010

CYBER Fixed Module Drive
Learning Activity 7-C

- g. Run FMC module 2, with the parameter changed to reload the controlware.

Instructor Checkpoint JPB

9. D88- To run D88, refer to procedure 1-3 in the 7155 Troubleshooting Guide (Rev. D or later).

- a. Run the confidence/verification modules of D88. Your instructor will direct you if any additional modules are to be run.

Instructor Checkpoint JPB

10. FMD-Refer to procedure 1-4D in the 7155 Troubleshooting Guide (Rev. D or later) and run FMD in the Detection/Isolation Mode.

- a. What values are used for parameters, P4 and P5?

P4=4000 P5=10

- b. What access level is required for FMD? 3

Instructor Checkpoint _____

11. FMU- Your instructor will specify operations to be performed using the Utility FMU.

12. D44-If you are responsible for maintaining 844s, on a 7155 controller, your instructor will direct you to run D44 on an 844 unit.

13. DTC-If you are responsible for maintaining 844s, on a 7155 controller, your instructor will direct you to run DTC on an 844 unit.

Instructor Checkpoint JPB

CYBER Fixed Module Drive
Learning Activity 7-C

MSL Procedures:

1. You will be required to go through the steps that would bring an FMD subsystem to an operational state, using the off-line (DEMOT) diagnostics FMC, D88, and FMD and the utility program FMU. If you are responsible for maintaining 844s, you should also run D44 and DTC.
2. Your instructor will direct you to the equipment to be used during this activity.

NOTE

Make sure the disk unit is powered up and ready.

Power on and press the master clear switch in the upper right-hand corner of the controller. The P register LEDs should now read 21BF, 20677 octal, (Refer to figure 2-1 in the 7155 Troubleshooting Guide). If the P register does not read 21BF, go the the controller isolation/correction procedure (table 2-1) in the 7155 Troubleshooting Guide and follow the instructions. If the P register does read 21BF, enable the proper switches on the controller switch panel for the channel accesses and the drive ports. (See figure 1-3 in the 7155 Troubleshooting Guide.) At this time, the maintenance switch and the channel enable switches on the 885 drives should be pressed. Remember, there are six switches, three for each spindle.

3. Perform the first three steps of procedure 1-8D in the 7155 Troubleshooting Guide. This will bring up the system configuration display. (Procedure 1-8C if TSG is Rev. B or later.)
4. Check to make sure that items 6, 7, and 8 are not assigned to the same channel as the FMD subsystem. If one of them is assigned to the FMD subsystem channel, reassign it by typing 6.X, where X equals an unused channel.
5. Perform steps 4 and 5 of procedure 1-8D in the 7155 Troubleshooting Guide. (Steps 4, 5, and 6 of procedure 1-8C if TSG is Rev. B or later.)

Instructor Checkpoint

CYBER Fixed Module Drive
Learning Activity 7-C

6. This procedure downloads controlware from the MSL tape to central memory to the 7155 controller. Type:

```
CP*4, MCX,0,5
CP*5, MLD,0,5
RU*4, 101
RU*5, 101
PP*4
LOADCM FMC (02, 020, 02A, 02B)
LOADCM S=FMD
A, CH=XX, EQ-0, UN=4X, DC=7, AL=10, SN=123456
P, P4=4000, P5=10
R, FMC (02)
```

7. If the module FMC02 completed, go to procedure 8. If not, follow the diagnostic message to read controller LEDs. This will refer you to table 2-1, controller isolation/correction in the 7155 Troubleshooting Guide.
8. Controlware is now loaded into the 7155 controller, and it is in its idle loop. The P register should read 21BF. If the above procedures have not executed properly, consult your instructor.

Instructor Checkpoint PPA

9. If another disk subsystem (844/855) on which to copy the MSL tape is available, use procedure 10.. If not, use procedure 19.

NOTE

Consult your instructor. He will direct you to the appropriate procedure.

10. Repeat procedures 3 and 4.
11. Type TDX and follow the tape to disk routine procedure, page 7-20 of the MSL Reference Manual. This will copy the MSL tape out to your disk. This copy routine will take approximately 20 minutes. The word end appears if the copy was successful.

CYBER Fixed Module Drive
Learning Activity 7-C

NOTE

When copying the MSL tape to an 844 drive, the starting cylinder must contain six consecutive flaw-free tracks. If problems are encountered, try another cylinder address, for example, 0567.

12. Repeat procedures 3 and 4. Change system configuration items 11 through 17 to load CMSE from the disk. Perform steps 4 and 5 of procedure 1-8D in the 7155 Troubleshooting Guide. (Steps 4, 5, and 6 of procedure 1-8C if TSG is Rev. B or later.)
13. To load and execute DEMOT, type the following CMSE commands.

```
*DP, OUTPUT
CP*4, MCX,0,5
CP*5, MLD,0,5
RU*4, 100
PP*4
DEMOT S=FMD
RU*5, 100
A, CH=XX, EQ=0, UN=4X, AL=10, DC=7, SN=123456
```

14. This procedure will store controlware out on cylinder 1511 of the 885 spindle assigned in procedure 13. Type:

```
P, P1=1511, P2=2, P3=XX
Where XX=37, 40, 41
R, FMU(05)
G
```

Repeat the preceding commands three times with a new value for XX each time. This will set a track flaw. Only three sector flaws are allowed on this track. If you add more sector flaws to the utility map, there will not be enough sectors available to hold the controlware. This will result in an error while executing FMU21.

After a total of three sector flaws have been set, type:

```
P, P1=0, P2=0, P3=3
R, FMU(21)
```

If this procedure completes, go to procedure 15; otherwise go to procedure 16.

Instructor Checkpoint _____

CYBER Fixed Module Drive
Learning Activity 7-C

15. This procedure will write the diagnostic patterns out to the 885 disk.

Type: R, FMU(23)
G

16. If you entered this procedure from procedure 14, type:
P, P4=4000, P5=1010
R, FMC(01, 02, 03, 07, 15, 16, 17, 18, 19, 21, 22, 23, 25,
27, 28, 29)

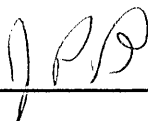
Otherwise, type:

P, P4=4000, P5=1010
R, FMC

NOTE

If any errors occur, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

Instructor Checkpoint



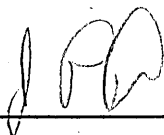
17. Run FMD, type:

P, P5=10
R, FMD

NOTE

If any errors occur, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

Instructor Checkpoint



CYBER Fixed Module Drive
Learning Activity 7-C

18. Run D88, type:

R, D88

NOTE

The diagnostic patterns written in procedure 15 must be present for a successful completion of D88. If any errors occur, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

Instructor Checkpoint 

- a. If you are responsible for maintaining 844s, your instructor will direct you to run D44 on an 844 unit.
- b. If you are responsible for maintaining 844s, your instructor will direct you to run DTC on an 844 unit.

NOTE

This completes the initialization of the subsystem and the diagnostics run. Your instructor will direct you if alternate procedures should be used.

Ask your instructor to initial the module title page for learning activity 7-C.

19. If no other disk subsystem is available, you must use the same controller (7155) to load diagnostics and run diagnostics. You have the following choices.

- a. Run all diagnostics from the MSL tape.
- b. Copy the MSL tape to one of the 885 spindles. Then you will not be able to run modules FMC17, FMC31, FMC33.

CYBER Fixed Module Drive
Learning Activity 7-C

If you choose choice a, the FMC diagnostic will take approximately two hours to load and execute. The FMD diagnostic will take about 25 minutes. If you choose choice a, go to procedure 20. If you choose b, go to procedure 23.

NOTE

Consult your instructor. He will direct you to the appropriate procedure.

Instructor Checkpoint _____

20. Repeat procedures 3 and 4.

21. To load and execute DEMOT, type the following CMSE commands.

```
CP*4, MCX, 0, 5
CP*5, MLD, 0, 5
RU*4, 101
PP*4
DEMOT S=FMD
RU*5, 101
A, CH=XX, EQ=0, UN=4X, AL=10, DC=7, SN=123456
```

22. Go to procedure 14.

23. Repeat procedures 3 and 4.

24. Repeat procedures 11 and 12.

25. To load and execute DEMOT, type:

```
*DP, OUTPUT
CP*4, MCX, 0, 5
CP*5, MLD, 0, 5
RU*4, 100
PP*4
DEMOT S=FMD
RU*5, 100
A, CH=XX, EQ=0, UN=4X, AL=10, DC=7, SN=123456
```

CYBER Fixed Module Drive
Learning Activity 7-C

NOTE

In this mode, you will not be able to run diagnostics on the spindle that contains the copy of the MSL tape.

26. This procedure will store controlware out on cylinder 1511 of the 885 spindle assigned in procedure 25. Type:

P,P1=1511,P2=2,P3=XX
Where XX=37,40,41
R,FMU(05)
G

If DRIVER DETECTED ERROR-SEE DAYFILE message appears, type:

R,FMU(05)
G

Continue on with this procedure. This message should only appear once.

Repeat the preceding commands three times with a new value of XX each time. This will set a track flaw. Only three sector flaws are allowed on this track. If you add more sector flaws to the utility map, there will not be enough sectors available to hold the controlware. This will result in an error while executing FMU21.

After a total of three sector flaws have been set, type:

P,P1=0,P2=0,P3=0
R,FMU(21)

If this procedure completes, go to procedure 27, otherwise go to procedure 28.

Instructor Checkpoint _____

27. This procedure will write the diagnostic patterns out to the 885 disk. Type:

R,FMU(23)
G

CYBER Fixed Module Drive
Learning Activity 7-C

28. If you entered this procedure from procedure 26, type:

P,P4=4000,P5=1010
R,FMC(01,02,03,07,15,16,18,19,21,22,23,25,27,28,29)

otherwise, type:

P,P4=4000,P5=1010
R,FMC

29. Complete procedures 17 and 18.

CYBER Fixed Module Drive
Learning Activity 7-D

LEARNING ACTIVITY 7-D. LABORATORY: ELECTRICAL

During this activity, you will perform the 885 and 7155 voltage checks and adjustments and the 885 servo adjustment.

OBJECTIVE

- You will be able to perform specified electrical checks and adjustments on the CDC CYBER FMD subsystem.

REFERENCE MATERIALS

<u>Title</u>	<u>Publication Number</u>
FMD Controller Manual	GF60455690
BZ703 CYBER Diskstorage Manual Volume 1	GF83322860
7155 Troubleshooting Guide	60456010
MALET Documentation	53140094

EQUIPMENT/TOOLS

The following equipment is necessary for this learning activity.

- Standard site tools.
- FMD maintenance tools and materials as listed in table 2-1 of the BZ703 CYBER Disk Storage Manual, Volume 1.
- Controller Maintenance tools as listed in the FMD Controller Manual.
- 855 (BZ703) Fixed Module Drive.
- 7155 (FA211) controller.
- 6000, or CDC CYBER 7X, or CDC CYBER 17X computer.

CYBER Fixed Module Drive
Learning Activity 7-D

- Operating system with CML installed containing all FMD diagnostics, or Off-line Maintenance System Library (CMSE) with DEMOT, or SMM with MALET diagnostics.
- Microfiche viewer.

PROCEDURES

To complete this learning activity, perform the following procedures.

1. Your instructor will direct you to the equipment for this learning activity.
2. Perform the FMD voltage checks and adjustments as described in the BZ703 CDC CYBER Disk Storage Manual, volume 1 section 2C.
 - a. What voltages should be checked?
 - b. What voltages are adjustable?
+5V -5V
3. Perform the FMD servo (velocity gain) check and adjustment as described in the BZ703 CYBER Disk Storage Manual, volume 1, section 2C, method 2 and the 7155 Troubleshooting Guide, section 1.

NOTE

Your instructor will direct you while you do this procedure.

CYBER Fixed Module Drive
Learning Activity 7-D

- a. What module of FMD must be used to perform the servo check and adjustment?

FMD 70

- b. To what value should the positioning time be adjusted?

330

4. Perform the 7155 controller electrical inspection as described in the FMD Controller Manual, section 6.

Instructor Checkpoint _____

5. Go over all Installation and Checkout procedures as described in section 3 of the FMD Controller Manual and section 1 of the BZ703 CYBER Disk Storage Manual, Volume 1. Although you will not do these procedures at this time, observe all steps of the procedures to ensure you understand what is involved in installation and checkout.

CUSTOMER TRAINING

You will be expected to instruct the Customer on proper operation of the subsystem. You should be able to instruct the Customer/Operator on filter and cosmetic cleaning, how to run the confidence tests, FMU Utilities, and convey the preservice forecast code along with the request for service. If you have any questions on these tasks, ask your instructor now.

Instructor Checkpoint _____

NOTE: Ask your instructor to initial the module title page for Learning Activity 7-D.

LEARNING ACTIVITY 7-E. LABORATORY: FAULT ISOLATION

During this activity, you will troubleshoot the CDC CYBER FMD subsystem by using the diagnostic error messages and the troubleshooting guide to perform corrective action.

OBJECTIVE

- You will be able to isolate failures in the CDC CYBER FMD subsystem as indicated by the diagnostics and troubleshooting guide.

REFERENCE MATERIALS

<u>Title</u>	<u>Publication Number</u>
FMD Controller Manual	GF60455690
BZ703 CYBER Disk Storage Theory of Operation Manual	83322880
BZ703 CYBER Disk Storage Manual, Volume 1	GF83322860
7155 Troubleshooting Guide	60456010
Operator Troubleshooting/Maintenance Guide	60456650
MALET Documentation	53140094
CML Version 3 Reference Manual	60455980
MALET Reference Manual	60456020
SMM Reference Manual	60160600
MSL Reference Manual	60455770
7155 Disk Storage Subsystem Reference Manual	60455860

EQUIPMENT/TOOLS

The following equipment is necessary for this learning activity.

- Standard site tools.
- FMD maintenance tools and materials as listed in table 2-1 of the BZ703 CYBER Disk Storage Manual, volume 1.

CYBER Fixed Module Drive
Learning Activity 7-E

- Controller Maintenance tools as listed in the FA211 Controller Hardware Maintenance Manual.
- 885 (BZ703) Fixed Module Drive.
- 7155 (FA211) controller.
- 6000, or CDC CYBER 7X, or CDC CYBER 17X computer.
- Operating system with CML installed containing all FMD diagnostics or Off-line maintenance system library (CMSE) with DEMOT, or SMM with MALET diagnostics.
- Microfiche viewer.

PROCEDURES

To complete this learning activity, perform the following procedures.

1. Your instructor will direct you to the equipment for this learning activity.
2. During this activity, you will gain troubleshooting experience from instructor-induced malfunctions.
3. After your instructor places the problem in the subsystem, load and run the diagnostics in a sequence to isolate the problem to the drive or controller and then to the failing module or component.

NOTE

Use the diagnostic error messages and procedures in the 7155 Troubleshooting Guide to isolate and repair the problem.

4. Fill out a problem worksheet for each problem you troubleshoot.
 - a. Failing Diagnostics. List the diagnostic(s) and module that failed.
 - b. Significant Error Indications. List any diagnostic error messages and any equipment fault indicators or conditions or LED displays.

CYBER Fixed Module Drive
Learning Activity 7-E

- c. Suspected Failing Logic. List failing logic as indicated by the diagnostic message or troubleshooting guide. (Indicate controller or drive problem).
- d. Bad Module. Once the problem has been isolated to a logic module or component, record its location and type.
- e. Comments. It is a good idea to record problems. Review them with your instructor and laboratory partner.
- f. Instructor Checkpoint. Always ask your instructor to initial your problem worksheet.

**CYBER Fixed Module Drive
Problem Worksheet**

PROBLEM 1 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

PROBLEM 2 WORKSHEET

- ### a. Failing Diagnostics

- ### b. Significant Error Indications

- ### c. Suspected Failing Logic

- #### d. Bad Module

- e. Comments

- ## f. Instructor Checkpoint

PROBLEM 3 WORKSHEET

b. Significant Error Indications

d. Bad Module

f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 4 WORKSHEET

- a. Failing Diagnostics

- b. Significant Error Indications

- c. Suspected Failing Logic

- d. Bad Module

- e. Comments

- f. Instructor Checkpoint

PROBLEM 5 WORKSHEET

b. Significant Error Indications

d. Bad Module

f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 6 WORKSHEET

a. Failing Diagnostics

b. Significant Error Indications

c. Suspected Failing Logic

d. Bad Module

e. Comments

f. Instructor Checkpoint

PROBLEM 7 WORKSHEET

b. Significant Error Indications.

d. Bad Module

f. Instructor Checkpoint

PROBLEM 8 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 9 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 10 WORKSHEET

- a. Failing Diagnostics

- b. Significant Error Indications

- c. Suspected Failing Logic

- d. Bad Module

- e. Comments

- f. Instructor Checkpoint

CYBER Fixed Module Drive Problem Worksheet

PROBLEM 11 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

PROBLEM 12 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

**CYBER Fixed Module Drive
Problem Worksheet**

PROBLEM 13 WORKSHEET

a. Failing Diagnostics

b. Significant Error Indications

c. Suspected Failing Logic

d. Bad Module

e. Comments

f. Instructor Checkpoint

PROBLEM 14 WORKSHEET

- ### f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 15 WORKSHEET

a. Failing Diagnostics

b. Significant Error Indications

c. Suspected Failing Logic

d. Bad Module

e. Comments

f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 16 WORKSHEET

a. Failing Diagnostics

b. Significant Error Indications

c. Suspected Failing Logic

d. Bad Module

e. Comments

f. Instructor Checkpoint

**CYBER Fixed Module Drive
Problem Worksheet**

PROBLEM 17 WORKSHEET

a. Failing Diagnostics

b. Significant Error Indications

c. Suspected Failing Logic

d. Bad Module

e. Comments

f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 18 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

**CYBER Fixed Module Drive
Problem Worksheet**

PROBLEM 19 WORKSHEET

a. Failing Diagnostics

b. Significant Error Indications

c. Suspected Failing Logic

d. Bad Module

e. Comments

f. Instructor Checkpoint

CYBER Fixed Module Drive Problem Worksheet

PROBLEM 20 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

INSTRUCTOR CONFIRMATION

INSTRUCTIONS: When all objectives in the preceding laboratory session have been met, complete this form. Please fill in all the information asked for in each blank space. Next, the form must be signed by the lab instructor in the space provided. Then, remove this page and fold it so that the address on the back appears. Then staple it and mail it. When this form is received by ESE, the student's PLATO records will be updated to reflect mastery of this lab module.

STUDENT NAME: _____
(print)

EMPLOYEE NUMBER: _____

DEPARTMENT NUMBER: _____

PLATO SIGN-ON NAME: _____
(print)

PLATO GROUP NAME: _____

I certify that the above named student has satisfactorily completed all procedures and has met the objectives of Module 7 in the FMD Maintenance course.

INSTRUCTOR NAME: _____
(print)

INSTRUCTOR SIGNATURE _____ DATE: _____

COURSE TITLE: CYBER FMD Subsystem Fault Isolation
PRODUCT NUMBER: R0801

INSTRUCTOR COMMENTS:

STAPLE

STAPLE

FOLD

FOLD

FIRST CLASS
PERMIT NO. 8241

MINNEAPOLIS, MINN.

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN U.S.A.

POSTAGE WILL BE PAID BY

CONTROL DATA CORPORATION

Engineering Services Education
1009 Washington Avenue North
Minneapolis, Minnesota 55401

ATTN: Administration of Individualized
Instruction (NTHESE)

CUT ALONG LINE

FOLD

FOLD

MODULE 8

FMD TROUBLESHOOTING SIMULATION II

This module enables you to learn the techniques used in trouble shooting the CYBER FMD Subsystem. You will trouble shoot simulated problems in the hardware using a PLATO troubleshooting simulator.

PRETEST

There is no pretest or post test for this module. Mastery is awarded when all of the simulations required by PLATO learning management (PLM) are completed.

LEARNING ACTIVITIES

All simulations for this module are presented within one learning activity. As simulations are finished, PLM will indicate completion and log the number you have completed. All simulations must be completed in order to achieve mastery for this module.

<u>Activity</u>	<u>Description</u>	<u>Page</u>
8-A	PLATO: PLATO Troubleshooting Simulation. During this activity you will troubleshoot simulated hardware problems using a PLATO troubleshooting simulator.	8-2

CYBER Fixed Module Drive
Learning Activity 8-A

LEARNING ACTIVITY 8-A PLATO: PLATO TROUBLESHOOTING SIMULATION

In this activity you will trouble shoot simulated hardware malfunctions using a PLATO troubleshooting simulator.

OBJECTIVE

- You will be able to isolate and correct simulated malfunctions in the CYBER FMD Subsystem using a PLATO troubleshooting simulator.

DIRECTIONS

Sign on to the PLATO terminal. If you would like a review of the use of the troubleshooting simulator take the module introductory lesson. If you do not take the module introductory lesson, you may begin your first simulation.

APPENDIX A USING INDIVIDUALIZED INSTRUCTION

If this is your first experience with individualized instruction, you probably have a few questions. The information that follows will help you understand the nature of individualized instruction.

WHAT IS INDIVIDUALIZED INSTRUCTION?

Individualized instruction is a teaching method that is oriented toward the individual rather than the group. Individualized instruction--

- Determines what skills you possess that pertain to the topic of instruction.
- Determines what skills you must acquire.
- Allows you to acquire these skills at your own pace by studying a variety of learning activities.

Individualized instruction is structured around a student manual that guides you through the course and is also a learning resource. The student manual is divided into modules.

Each module contains information that will help you meet the objectives of that module. The information within the module is presented in learning activities.

MAY I WORK WITH OTHER STUDENTS?

Yes, if two or more of you are taking the course at the same time, it may be beneficial for you to do some of the learning activities together. Whether you work alone or with others depends on your needs.

HOW DO I PROCEED THROUGH THE COURSE?

You begin the course by signing on to the PLATO terminal. See appendix B for detailed instructions for signing on. You may want to take the pretest or you may ask for a full assignment that teaches all of the objectives of the first module. If you take the pretest, PLATO learning management (PLM) will evaluate the results of the test and assign the learning activities that are keyed to the objectives you did not master. Then, study the

Appendix A

assigned learning activities and retake the test. If you are successful, proceed to the next module and repeat the process until course completion. If not, study the assigned learning activities and retake the test until you master all the module objectives.

See figure A-1 for a flowchart illustrating your progress through the course.

HOW DO MODULES, COURSES, AND CURRICULA RELATE TO EACH OTHER?

The structure of the Engineering Services Training Program has three parts (see figure A-2):

- Module. A module is made up of learning activities. It contains objectives and test questions. A module teaches specific training tasks. For example, a module could cover electrical/mechanical adjustments.
- Course. A course is made up of modules. A course covers a single subject, for example, a course on the oscilloscope or magnetic tape unit.
- Curriculum. A curriculum is made up of courses. It covers a broad area of knowledge, for example, an entire subsystem. A curriculum may contain courses that range in complexity from introductory to advanced.

WHAT KIND OF RESOURCES ARE USED IN INDIVIDUALIZED INSTRUCTION?

Individualized learning activities use the following resources and combinations of those resources to present information.

- Text Reading. This resource presents information via the student manual and provides simplified explanations, drawings, and examples.
- Reference Reading. This resource directs you to read designated pages in a specified reference manual.
- Exercises. This resource presents information via the student manual. It uses a question/answer presentation. An exercise may be used to present new material or it may determine your comprehension of previously presented material.

Appendix A

- Programmed Text. This resource is a student manual text reading that presents information and asks for immediate feedback to determine your comprehension.
- Laboratory. This resource gives you actual hands-on experience with computer equipment.
- PLATO Assisted Learning. This resource presents information via the PLATO terminal.

Appendix A

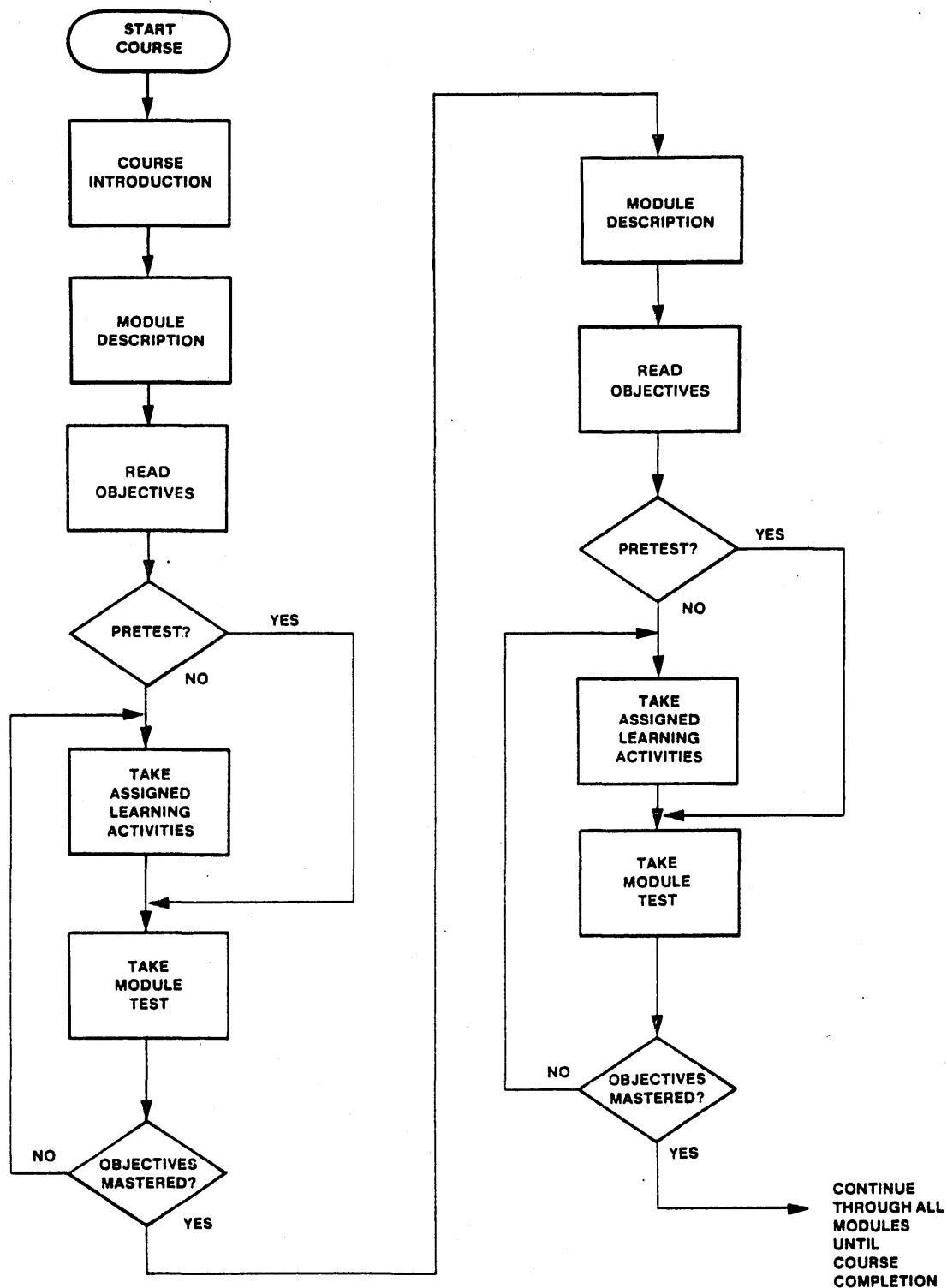


Figure A-1. Student Progress

CURRICULUM

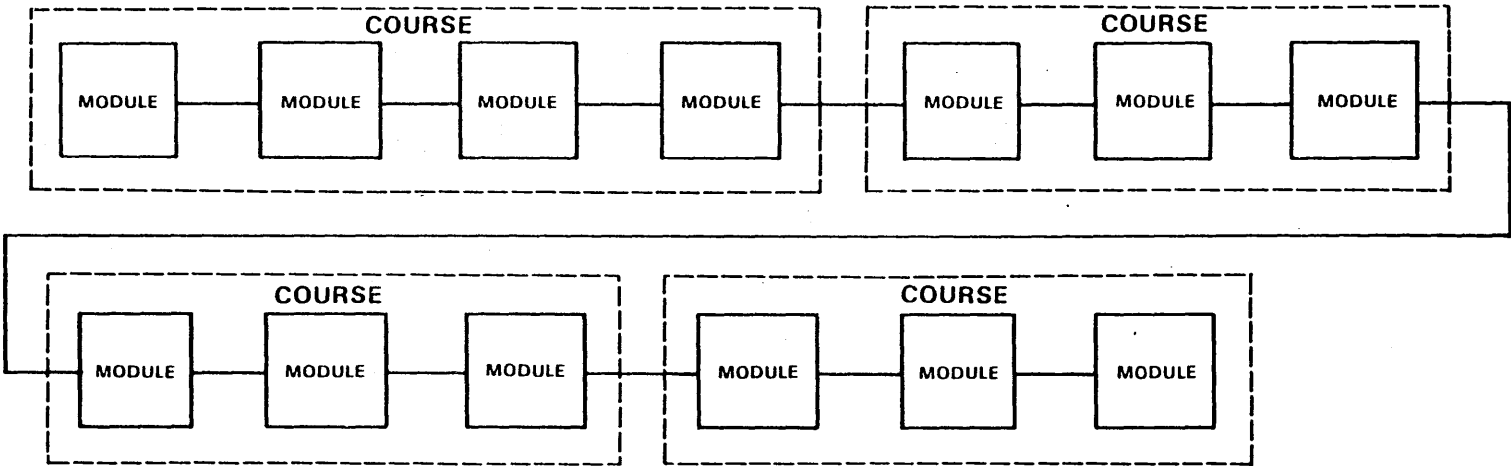


Figure A-2. Program Structure

Appendix A

- Audiotope. This resource presents an audio message via an audiotape machine.
- Microfiche. This resource uses a microfiche viewer and microfiche film to illustrate information.
- Videotope. This resource uses a videotape playback unit and videotape to present information.

You may proceed from one learning activity to another at your own pace. The learning activities are not long, but it is important that you take the time to understand the material before you go on to the next activity.

Each learning activity is coded with a number and a letter. The number stands for the module and the letter represents the order in which the learning activity is presented. The first learning activity of the first module is Learning Activity 1-A. The second activity is 1-B, and so on.

HOW DO I TAKE A TEST?

All testing is managed by PLATO learning management (PLM). PLM performs three important functions:

- Administers all tests.
- Assigns learning activities based on the results of the tests.
- Retains your student records for all courses you take within a curriculum.

PLM has two modes of testing, on-line and off-line. On-line testing requires that you sign on to a PLATO terminal to take the test. When you complete the test, PLM will assign learning activities based on the results of your test.

On-line testing is preferred because it saves time and enables you to proceed through your training without any delays.

Off-line testing is the more traditional method. Your administrator will give you a copy of the test and an answer sheet. Do not write on the test; record all your answers on the answer sheet. Return your test to the administrator, who will grade it and enter the results into the PLM system.

WHAT IS THE INDIVIDUALIZED INSTRUCTION TESTING PHILOSOPHY?

A test is a device that determines whether you have met the objectives of the course (module). It determines if you have acquired the skills that the course is designed to teach.

The number of times you take a test or your score on the test is not as important as the information you gain from the test results. The results tell you what areas you need to study.

Do not be alarmed if you need to take a test more than once. It is not your scores that count, it is your ability to perform your job that is important to you, Engineering Services' customers, and Control Data.

WHO ARE THE PERSONNEL INVOLVED IN INDIVIDUALIZED INSTRUCTION?

Regional Education Manager (REM)

The REM manages the training program for the region/country. He coordinates and administrates training activities to ensure that training needs are identified and fulfilled.

Regional Training Coordinator (RTC)

The RTC works with the education center manager to provide assistance as required; for example, he orders training materials, processes enrollments/confirmations, etc.

Education Center Manager (ECM)

The ECM administrates and coordinates training activities to ensure training delivery. For example, he provides a technical training advisor and identifies training materials requirements for the RTC. This individual may be a resource center manager, regional education manager, skill center manager or education center manager.

Education Training Coordinator (ETC)

The ETC manages the PLATO learning management (PLM) system. He provides the student with a student sign-on and PLM entries, and he works with the education center manager to solve PLM related problems.

Appendix A

Technical Advisor (TA)

The TA deals directly with the student. He monitors activities and provides guidance and assistance as required. A TA may be an engineer-in-charge, regional technical support instructor or a customer engineer with technical expertise.

Subject Matter Expert (SME)

The SME provides technical assistance for training problems that cannot be resolved by the technical advisor.

Learning Center Administrator (LCA)

The LCA works directly with the student to ensure smooth progression through the course.

APPENDIX B

PLATO SIGN-ON PROCEDURES

In order to begin the course you must first sign on to the PLATO system. Depending on where your terminal is located, you may first have to dial up the PLATO computer in order to establish communication between the computer and your terminal. If your terminal is on a direct connection, this is not necessary, and steps 2 and 3 can be skipped.

1. Turn power on.
- *2. Dial the number of the PLATO system using the data phone. When the system answers, you will hear a tone. The next step must be performed within three seconds after you hear the tone.
- *3. Lift exclusion button (usually located on the telephone cradle). Place the receiver on the table or in front of the cradle. Do not hang up.

NOTE

Some data phones require that you lift the exclusion button to dial, and hang up when the tone is heard.

4. Press the STOP key on the PLATO terminal keyboard.
5. Press the NEXT key on the PLATO keyboard. This causes the welcome to PLATO page to be displayed (figure B-1).
6. Enter your name exactly as you are registered in this course. Normally this will be your last name, followed by a space, and your first initial, with no capital letters (for example, smith j, as shown in figure B-2).

If you make a mistake, you can erase it by pressing the ERASE key on the right side of the keyboard.

7. Press the NEXT key. You will then be asked to enter the name of your PLATO group. Enter the name of the PLATO group in which you are registered. Once again, the exact spelling is required.

*Dial-up system only.

Appendix B

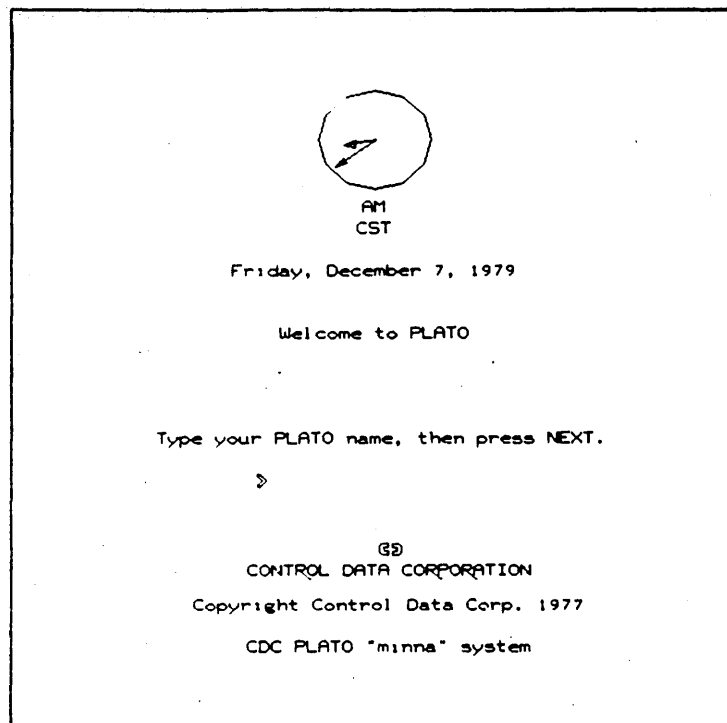


Figure B-1. Welcome to PLATO

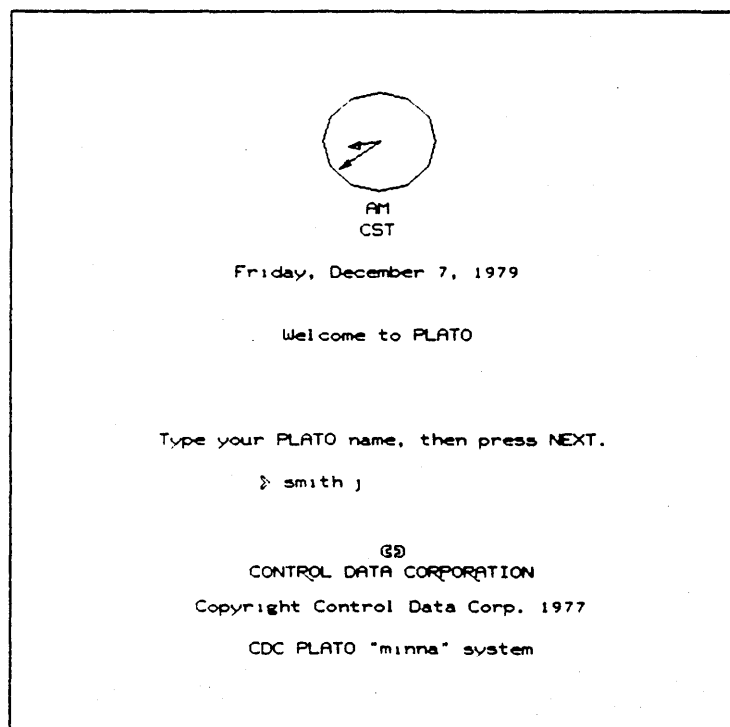


Figure B-2. Repeat

Choose a secret PASSWORD that you will remember. Do not tell anyone what it is.

As you type your password, several X's will appear so that nobody can see what you are typing.

Type your password, then press NEXT.

» XXXXXX

Figure B-3. Password

8. Hold down the SHIFT key and press the STOP key. You will then be asked to enter your password (figure B-3). Your password can be anything you choose, but it must be something that you can easily remember, such as a name, phone number, employee number, etc. Do not forget the password you have selected. It will become your key for gaining access to your lessons.

Appendix B

Choose a secret PASSWORD that you will remember. Do not tell anyone what it is.

As you type your password, several X's will appear so that nobody can see what you are typing.

Type your password, then press NEXT.

» XXXXXX

Try it again to make sure.

Type your password, then press NEXT.

» XXXXXX

Remember this password. You will be asked for it each time you use PLATO.

Press NEXT now.

Figure B-4. Password Repeat

9. Press the NEXT key. If this is the first time you have signed on to this course, you will be asked to enter your password again (figure B-4). Enter it again, just as you did before. From this point on you will be required to enter your password only once when you sign on.
10. Press NEXT. You are now signed on to the system.

APPENDIX C USING MICROFICHE

INTRODUCTION

This appendix provides the basics of selecting, loading, and viewing microfiche on a Micron 780 Microfiche Desk Reader or a similar reader. (See the Microfiche Handbook, available from Information Services, STPl09, for more information.)

The portable microfiche desk reader may also be used since it has the same capabilities as the Micron 780.

Consult the operator's manual for specific information on the readers.

SELECTION

Select the proper microfiche by consulting the microfiche header, which contains the title of the contents and the microfiche reference number (figure C-1).

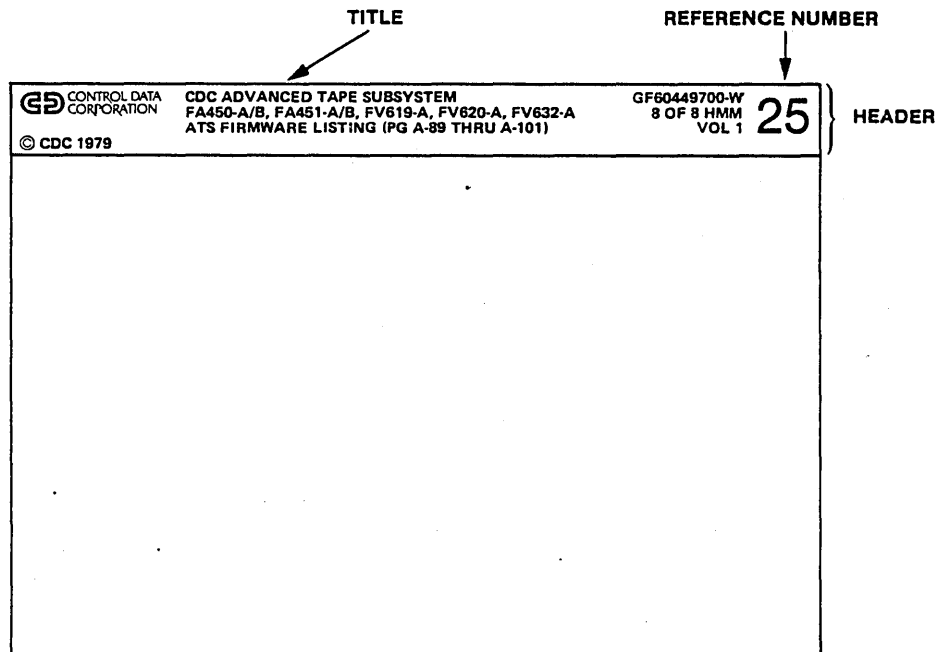


Figure C-1. Microfiche

(Manual Title)
Appendix C

LOADING

To load the Micron 780 Desk Reader or a similar desk reader, perform the following procedure (figure C-2).

1. Turn on the microfiche desk reader by pushing in on the side of the LOW-OFF-HIGH switch that indicates a low light intensity setting.
2. Pull the carriage assembly toward you until the glass covers flip up.
3. Hold the microfiche by the header with the printed information facing up (figure C-3).
4. Position the microfiche toward the upper right corner of either glass.
5. Push the carriage assembly back and position it so that a full picture with a index grid coordinate number is visible on the screen.
6. Select the proper index grid. Each microfiche desk reader is equipped with two index grids, a 24X index grid for 24X microfiche and a 42X index grid for 42X microfiche; most documentation is on 24X microfiche (figure C-4).

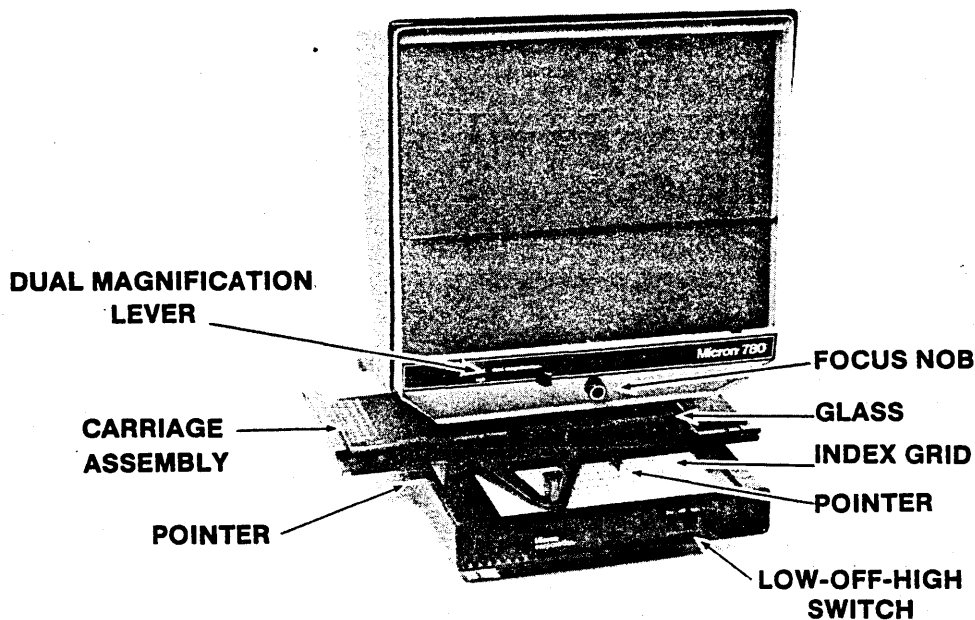


Figure C-2. Microfiche Desk Reader

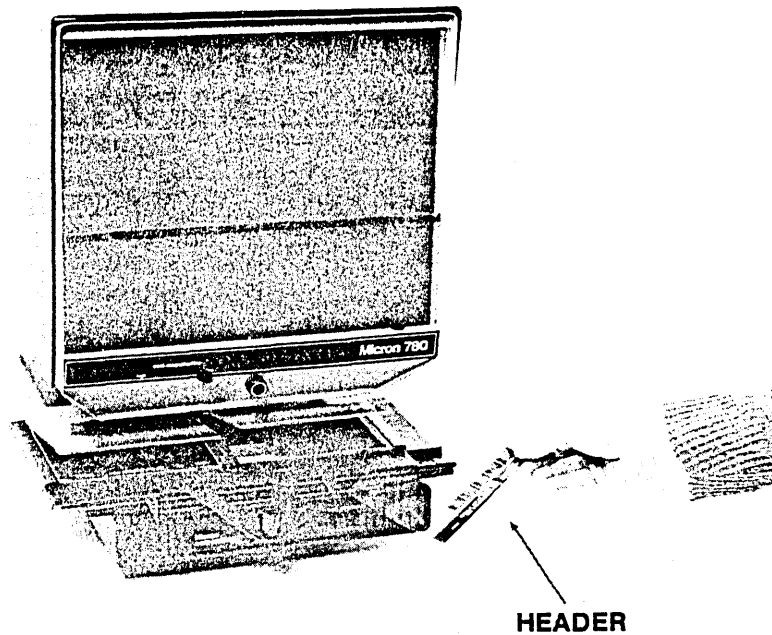


Figure C-3. Inserting Microfiche into Desk Reader

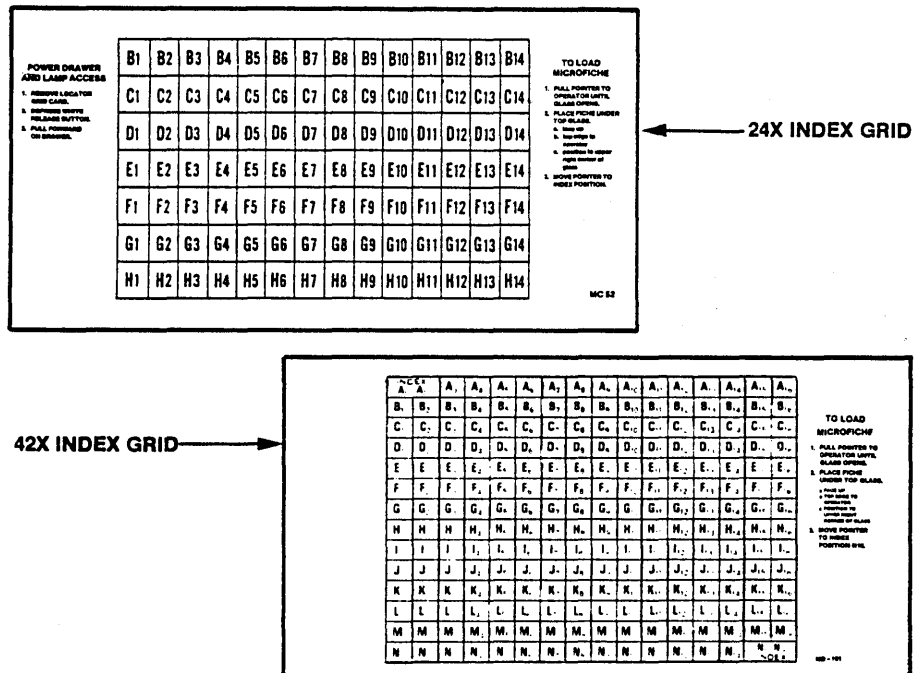


Figure C-4. 24X and 42X Index Grids

(Manual Title)
Appendix C

- a. The 24X microfiche has a 3/8-inch header, and the 24X index grid is divided into 14 horizontal boxes.
 - b. The 42X microfiche has a 1/2-inch header, and the 42X index grid is divided into 16 horizontal boxes.
7. Place the proper index grid so that the carriage pointer is centered over the index grid coordinate number that appears on the screen.

VIEWING

When viewing a logic diagram with a index grid coordinate number of B1, position the carriage pointer between B1 and B2 on the index grid. Adjust the carriage to obtain a full screen picture. Student manuals and audiotapes may call the coordinates B1/B2 on the index grid. B1/B2 indicates that the carriage pointer should be positioned between B1 and B2 on the index grid (figure C-5).

Other pages of technical manual can be viewed by placing the carriage pointer in the center of the index grid coordinate number (figure C-6).

Screen Quadrants

The desk reader screen is divided into four quadrants to reference any area of the screen (figure C-7). It has a transparent horizontal yellow line for the horizontal axis; you may need to add the vertical axis. Transparent map tape, clear tape, or grease pencil work well as the vertical axis.

Magnification

A dual lense microfiche reader, such as the Micron 780, can magnify any area of a 24X microfiche by using the high (42X) lense in the following procedure.

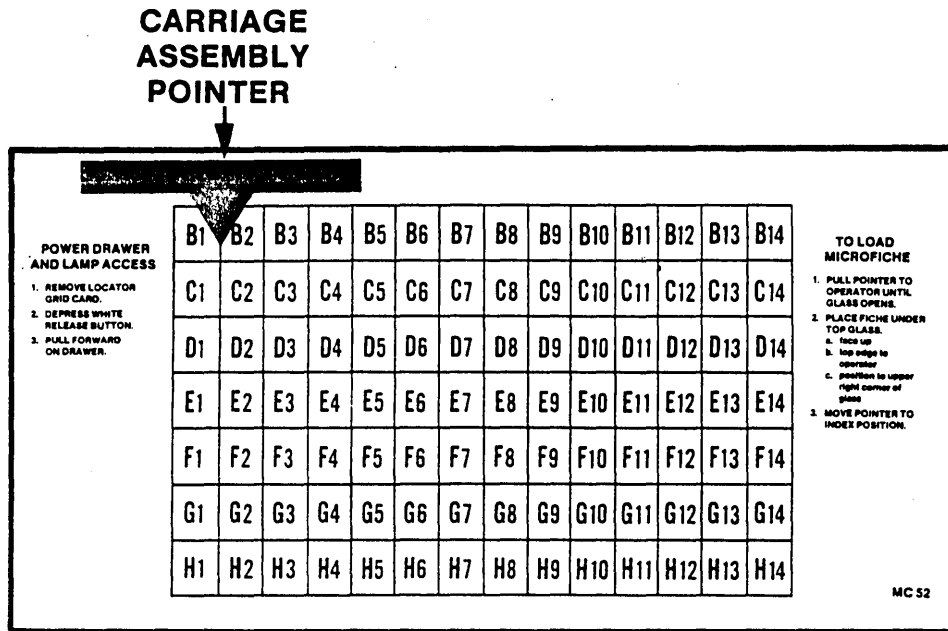


Figure C-5. Carriage Assembly Pointer Position for Technical Manuals

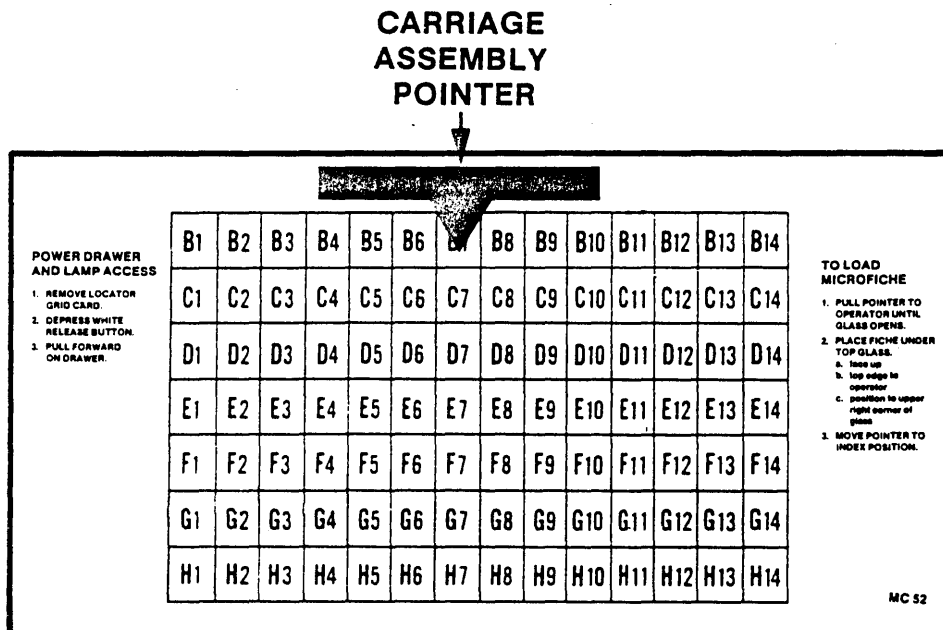


Figure C-6. Carriage Assembly Pointer Position for Logic Diagrams

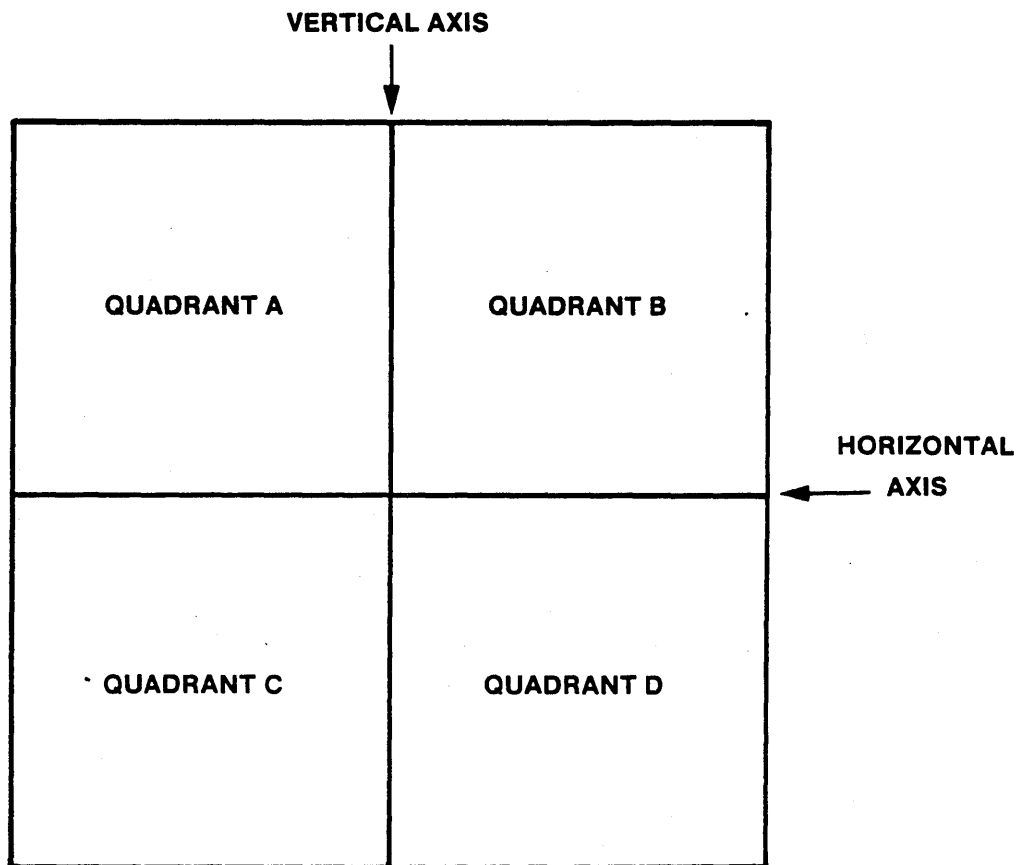


Figure C-7. Screen Quadrants

1. Position the area that you wish to magnify in the center of the screen using the carriage assembly (see figure C-2 for the location of the DUAL MAGNIFICATION lever).
2. Move the DUAL MAGNIFICATION lever to HIGH.
3. Return the magnification lever to LOW before moving on to another frame.

Light Intensity

The microfiche desk reader can deliver high or low light intensity. The Light Intensity switch is part of the LOW-OFF-HIGH switch.

The following suggestions may help reduce eye strain when using a microfiche desk reader for a long time.

- Do not watch the screen while moving to a different frame.
- Use low intensity light for low magnification and high intensity light for high magnification.
- Be sure the image on the screen is focused sharply (see figure C-2 for the location of the focus nob).
- Tilt the projector forward or backward.
- Vary the intensity of the room lighting.

Be sure to turn the viewer off whenever you are not using it. Extended exposure to light will fade the microfiche.

APPENDIX D

AUDIOTAPE SCRIPTS

LEARNING ACTIVITY 3-K. DETAILED BLOCK DIAGRAM

This learning activity describes the eight-eighty-five CYBER Fixed Module Drive Detailed Block Diagram. This block diagram is figure three-dash-thirty-nine in the Student Manual. If you are not now at figure three-dash-thirty-nine in the Student Manual, stop this tape and go to that page.

Figure 3-39.

Along the sides of the block diagram, notice the letters -A-, -B-, -C- and -D-. We will use the terms alpha, bravo, charlie, and delta when referring to these letters. Across the top and bottom of the page are the numbers one, two, three and four. This is the coordinate system for locating signals and blocks on the block diagram. We will be using these as we go over the block diagram.

Now turn the page and you will find figure three- dash-forty. The next page is figure three-dash-forty-one, etc. for a total of seven figures. All figures are of the same detailed block diagram with the same coordinate system on each page.

Notice that different areas on each page are highlighted. As we go through this learning activity, we will be describing the highlighted areas on each page. Also, keep in mind you may stop the tape to make notes, or rewind it to go back over material at your convenience.

Figure 3-39.

Let's begin with figure three-dash-thirty-nine and take a look at the block diagram. At coordinate three delta, locate the block labeled desired velocity circuits. Notice in parenthesis the number thirty-six. The number thirty-six tells us the desired velocity circuit is on the logic board at location thirty-six.

The logic chassis, has one row of logic for device -A-, the -A- row, and one row of logic for device -B-, the -B- row. The desired velocity circuit and the entire block diagram can apply to either device -A- or device -B-. Bubble-five, a circle with a five in it, goes to the desired velocity circuit. The arrow on

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bubble-five, ties it to the bubble-five at coordinate one charlie which is from a circuit called the difference-counter.

Where is the difference counter logic board located? The number in parenthesis tells us that the difference counter is at board location fifteen. By following the bubble-five from the difference counter, to the desired velocity circuit at coordinate three delta, we can follow signals from one point to another on the block diagram. This eliminates drawing so many lines on the block diagram.

Let's start to analyze the block diagram. In previous activities, you have studied the interface signals between the device and the controller. Now, let's see how they are used in the block diagram. Refer to coordinate four charlie.

There you will see a group of four signals labeled from-controller-one. Below them, a note tells us these are uni-directional lines. The four signals from controller-one are labeled select, disable-reserve, write and read. These four signals go into the channel-one receivers at board location three. Notice right below are, the channel-two-receivers, also at board location three.

This block diagram is for a single-access device, but the channel-two-receivers for the four signals will always be present. This is because they are on the same logic board as the channel-one-receivers.

After passing through the channel-one-receivers, the four signals fan-out to the rest of the device logic. The write-and-read signals are partial enables for write and read operations that we will describe later.

On this block diagram, we can see that the channel-one-select-signal and the channel-one-disable-reserve-signal go straight across the page to the block labeled dual-channel-logic at board location twenty. This logic board has the reserved-circuits that decide whether the channel-one-controller, or the channel-two-controller, is able to connect to this device. This is useful when the dual-access-feature is present, because only one controller at a time can operate with the device.

With a single-access-device, the channel-one-select unconditionally sets the reserve-logic. The channel-disable-reserve-signal is used to disable the reserve condition of the opposite channel. With a dual-access-device, the channel-one-reserved-signal could be used to clear channel-two's reserved-logic. Normally, the channel-disable-reserved-signal is used when it is known the other channel is inoperative.

Also, on the logic board, at location twenty, are the device-unique ID-switches. The device-unique ID-switches should be set to give the device a unique eight bit identification number.

The channel-one-select-signal to the dual-channel-logic-board, generates the channel-one-select-and-reserve-signal. You can see this signal going to the channel-one-transmitters at board location three. Notice right below, are the channel-two-transmitters, also at location three. So even though it's a single-access-device, the channel-two-transmitters are always present.

Let's look at the signals that the channel-one-transmitter sends on the six uni-directional lines to the controller. The first signal is the select-and-reserve-one-signal, which we have just discussed. Second, is the on-track or on-cylinder-signal. This will be generated whenever the carriage is stopped at a cylinder-address.

Next, is the sector-mark and on-sector line. This line is used for both signals. The sector-mark is generated for each of the thirty-four physical sectors. The on-sector signal, which we will discuss more later, is generated whenever there is a compare between the sector-address. This is requested by the controller and the contents of the sector-counter, in the device.

Fourth, the write-clock-signal is sent to the controller, and is used by the controller during write operations to run controller timing. Fifth, is the index-signal, the main reference timing mark. This is generated once-per-revolution of the disk-pack, from the index-pattern that was prerecorded on the servo-disk-surface. The sixth signal is ready-and-safe. This will be sent to the controller whenever the device is on-cylinder, and there are no error conditions.

We have described the four interface signals from the controller, and the signals sent to the controller on the six uni-directional lines.

Figure 3-40.

Turn to figure three-dash-forty in the Student Manual.

At coordinate four bravo, find the signals labeled to-and-from-controller one. Above the labeled signals is a note that tells us there are ten bi-directional lines. In this diagram, for simplicity, one line coming from the controller, and another

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line going to the controller is shown. In reality, there are ten bi-directional lines with signals going both ways on the same line.

First, let's follow the signals coming from the controller to the device. There are eight bits labeled C-M-D bus-out-bits, two-to-the-zero through two-to-the-seventh, plus a parity bit, for the command and bus-out-lines. These commands can either be four -X- or eight -X- commands.

In previous learning activities the four -X- commands were called the control-commands, and the eight -X- commands were called the status commands. Whatever command is issued, there will be a bus-out-data-word following it.

On the line from the controller, find the signal labeled tag-gate. This is used to clock the command or bus-out-word into the device. Follow the command or bus-out-bits down the page to the channel-one-receivers at board location two. The bits will go through the receiver, to the right, to the I-O buffer at board location twenty-one.

This I-O buffer is actually the controller-one or controller-two-fan in. Since this is a single-access-device, the channel-two-receivers are not shown. If they were present, they would be at board location four, and there would be two paths into the I-O buffer.

From the I-O buffer, our command bits go to the right, into the control-command-register, at board location twenty-two. After the controller sends a command, it then sends the bus-out-word. The bus-out-word takes the same path to the I-O buffer.

Now, from the I-O buffer, follow the line up the page to coordinate two charlie. Locate the bus-out-register at board location twenty-two. The bus-out-bits will be loaded into this register.

Let's use for example, the controller loading the head-address-register. First, the controller would send the command, which passes through the channel-one-receivers to the I-O buffer, and into the control-command-register. There it would be decoded as the head-address-command. This is not the head-address itself.

Second, the controller would send the bus-out-word, which is actually the head-address. It then passes through the channel-one-receivers, the I-O buffer, and into the bus-out-register. The top line out of the bus-out-register goes to the head-address register at board location fifteen.

Below the head-address-register, in the block diagram, is the difference counter at board location fifteen. Below that, is the cylinder-address-register at board location sixteen and a target-register. The target-register at board location twenty-eight is loaded with the sector-address.

The difference-counter and the cylinder-address-register consist of an upper and lower register. For example, to load the cylinder-address-register, the controller sends a command to load the upper-cylinder-address, and the bus-out-word is loaded into the upper-cylinder-address-register. The controller then sends a command to load the cylinder-address-lower, and the bus-out-word is loaded into the lower cylinder-address-register.

So it would be command, bus-out, command, bus-out, to get the upper and lower cylinder-register loaded. The same procedure would apply to load the upper and lower difference-counter.

Refer back to coordinate four bravo on the left side of the page. On the same line as the tag-gate-signal, is the fast-start-signal. This signal is used during a read operation that we'll describe later.

You'll notice that there are two other signals labeled write-clock and non-returned-to-zero-write-data. They are on the same line as bus-out-bits, two-to-the-first and two-to-the-zero, and are used during a write operation, that we'll describe later.

We have followed the command-bits through the receivers, I-O buffer to the command-control-register, and bus-out-bits through the receivers to the I-O buffer, and bus-out-register. Also, depending on the command, we've loaded the head, difference, cylinder, and target-register.

Figure 3-41.

Turn to figure three-dash-forty-one in the Student Manual.

Now, refer to coordinate four bravo. This time we will follow the signals that the device sends to the controller. The eight bus-in-bits are labeled bus-in, two-to-the-zero through two-to-the-seventh, plus the parity-bit.

Below, is the signal called tag-status-valid. This signal gates the bus-in-status-word into the controller. The read-clock and non-return-to-zero-read-data are on the same lines as bus-in-bit, two-to-the-first and two-to-the-zero.

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We described sending four -X- and eight -X- commands to the command-control-register where they are decoded. As you recall from previous learning activities, anytime a command is sent from the controller, the device will send a status-word-back to the controller. Refer to coordinate one bravo and locate the status-shift-register at board location twenty-one.

We will assume the status-word is already in the status-shift-register. The output of the status-shift-register goes down the page to bubble-one. Now, continue to the left to coordinate three alpha. Bubble-one is at the top of the I-O buffer board. The status-word goes through the I-O buffer, and down the page to bubble-eight.

At coordinate four alpha bubble-eight becomes bus-in-bits two-to-the-zero through two-to-the-seventh, the parity bit, and status-valid to the channel-one-transmitters at board location two.

Now going up the page and back to the left, are the ten bi-directional lines to controller-one. The transmitters for the channel-two-controller are on the logic board at location four. Because this block diagram is for a single-access- device, the logic board four is not shown.

Let's see how we initially get a status-word to the status-shift-register. Refer back to coordinate two alpha and locate the control-command-register. Now follow the enabling lines out of the control-command-register, up to the selection-section of the status-selection-multiplexer-network. Three logic boards make up this status-selection-multiplexer-network at board location twenty-five, twenty-six, and twenty-seven. But only one status-word at a time, will be enabled through the multiplexer-network or gates, to the status-shift-register.

The board at location twenty-five will be enabled when the control-command-register contains a forty through forty-seven command.

The data-input-section of the board at location twenty-five has five possible inputs. The top input comes from the difference-counter. The second line is from the head-address-register. The third input is from the cylinder-address-register.

The fourth input is from bubble-three. Refer to coordinate three charlie and find bubble-three from the sector-counter. The fifth input to board twenty-five of the status-selection-multiplexer-network is the target-register.

The board, at location twenty-six, will be enabled when the control-command-register contains a forty-eight-through forty -F- command. The data-input-section shows two inputs. To the left there is a block labeled interface control circuits. These are on logic boards twenty-two and twenty-three.

The other input comes from the block labeled H-D-A sequence circuits. These are on logic boards thirty-one and thirty-two. There are other inputs to board twenty-six, but these are the major inputs.

The board, at location twenty-seven, will be enabled when the control command register contains eight -X- commands. The inputs, at location twenty-seven, are shown in a block labeled read-write-control from board twenty-four; H-D-A-sequence-two from board thirty-two; head-select from board sixteen; and servo-control from board thirty-three and thirty-four. Once again, these are the major inputs.

There is one other input through the OR gates to the status-shift-register at co-ordinate one bravo. By following the line down the page and back to the left, you'll see that it comes from the C-M-D bus-status-mux at board location twenty-three. This is used by the four -C- set-diagnostic-command, which can echo the contents of the control-command-register or bus-out-register, through the status-path, to the controller.

The left inputs to the C-M-D bus-status-mux comes from the control-command-register. The bottom input is bubble-two. Refer to co-ordinate two charlie, and find bubble-two from the bus-out-register.

We have seen that the four -X- and eight -X- commands enable one-status-word to the status-shift-register, I-O buffer, channel transmitters, and bi-directional lines to the controller.

Figure 3-42.

Turn to figure three-dash-forty-two in the Student Manual.

The areas highlighted are the circuits for positioning the heads to any one of the eight-hundred-and-forty-four stopping positions on the disk surface. In the upper right hand corner of the page at coordinate two delta is the head-positioner-mechanism. This represents the magnet, voice coil, and carriage to which the heads are attached.

The servo-head reads the quadbits from the servo-disk-surface. To the right of the servo-head is bubble-seven and a wave shape that shows the quadbits of the servo-byte that you studied in previous learning activities.

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Follow bubble-seven over to coordinate four charlie where it's labeled quadbits-from-servo-head-in-H-D-A. We will follow these quadbits, and describe how they're used in the highlighted areas to generate the voice coil current which controls positioning at co-ordinate two delta.

Before we look at the block diagram, let's take a few minutes to describe some of the operations of the head-positioning-system. There are four types of positioning operations. The first is a direct-positioning operation. That is positioning the heads to any of the eight-hundred-and-forty-four cylinder-addresses. The second is a power-on rezero-seeking-operation. This brings the disk pack to thirty-six-hundred revolutions per minute. It then moves the heads from the home position through the outer-guard-band to cylinder-zero.

The third action occurs during a power-off-go-home-seeking-operation. The heads move from any cylinder-address through the outer-guard-band to the home position. The last type of positioning operation is the rezero-seeking. The heads move from any cylinder, back to cylinder zero, at a very low rate of speed. This is usually an error recovery operation.

Let's use the block diagram to describe a direct-seeking-operation and the logic-boards involved. The controller will load the cylinder-address-register and the difference-counter, at co-ordinate two charlie, before a direct-seeking-operation begins. The cylinder-address-register contains the address of the cylinder that the carriage will move to. The difference-counter contains the difference between where the carriage is at now, and where it will be positioned. Both the cylinder-register and difference-counter are available as status to the controller.

Let's follow the output of the difference-counter to bubble-five in the block diagram, to coordinate three delta. This is one of the inputs to the block labeled desired-velocity- circuits at board location thirty-six. Part of the desired velocity circuit is a digital-to-an-analog-converter-network. Here the contents of the difference-counter is changed to an analog-voltage.

Notice in the block diagram, to the right of the desired-velocity block there is an analog waveshop. When the difference is more than one-hundred-and-twenty-seven tracks, the analog-voltage is at maximum. As the difference decreases from one-hundred-and-twenty-seven to zero, the analog-voltage also decreases to zero. This voltage goes through the position-control-circuits at board location thirty-five.

The output of the position-control-circuits goes to the power-amp-circuit. Notice in parenthesis, the letters D-C. This tells us the power-amp-circuit is physically located in the D-C power supply. The output of the power amp circuit is the actual current through the voice coil of the head-positioning-mechanism. The amount of current is determined by the analog-voltage generated from the value in the difference-counter.

As the carriage moves, the servo-head reads the prerecorded information from the servo-disk-surface. In the block diagram, follow bubble-seven over to coordinate four charlie. You will see that the quadbits from-servo-head-in-H-D-A, go through the quadbits-servo-decoder at board location thirty-nine.

Follow the top output of the quadbit-servo-decoder to the block labeled plus-and-minus-position-circuits, also at board location thirty-nine. The output of the plus-and-minus-position-circuits is a analog wave shape shown at coordinate four delta. It is a sign-wave-type-signal that crosses the zero volt reference when the servo-head crosses a track.

To the right of the position circuit is a block labeled track crossing. This circuit is on logic boards thirty-six and thirty-seven. The track crossing circuit generates a incrementing pulse that goes to the difference-counter, at bubble-six.

As soon as the carriage starts to move, the track-crossing signal causes the difference counter to decrement. When there are less than one-hundred-and-twenty-eight tracks to go, the output of the -D- to -A- converter will decrease toward zero.

At co-ordinate four delta, the top output of the plus-and-minus-position-circuits, goes to the actual velocity-detection-circuit at board location thirty-seven. This circuit, monitors the analog-sign-wave for the speed of the track crossing. When the carriage is stopped, the actual velocity voltage is zero.

As the carriage moves, the output voltage increases. The faster the carriage moves the more voltage. The adjustment for servo-speed is at board location thirty-nine. It effects the amount of analog-velocity-feedback-voltage that can be generated. The actual velocity-feedback-voltage is shown, at the right of the actual-velocity-detection-circuit.

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Note that it is the opposite polarity to the desired-velocity-voltage from the -D- to -A- converter, at board location thirty-six. For example, when moving from cylinder-zero to cylinder-four-hundred, initially, there would be a lot of desired-velocity-voltage from the -D- to -A- converter, and very little actual velocity-feedback-voltage. As the carriage begins to move, the actual velocity-feedback-voltage increases, and a point is reached where the two voltages cancel each other.

At this point, the carriage quits accelerating, and coasts until there are less than one-hundred-and-twenty-eight tracks to go. The desired-velocity-voltage then decreases so there is more actual velocity-feedback-voltage. This reverses the current to the voice-coil, and slows the carriage.

The position-control-circuits, on the logic board at location thirty-five, contain the gating-circuits for controlling the positioning operation. The forward and reverse gating circuits, control the polarity of the voltage to the voice coil, for determining the direction of carriage movement.

When the carriage is stopping at a cylinder-address, the position control circuits switch from using the -D- to -A- converter, to using the sign-wave-analog-voltage. This is from the plus-and-minus-position-circuits, to hold the carriage, on-cylinder.

The logic generates the plus-and-minus-analog-voltage from the servo-surface and head. Therefore, any movement of the carriage is immediately detected and the correction-voltage is generated. The other positioning operations, such as, power-on rezero seek, power-off go home seek, and the rezero-seek are controlled by the gates on the position-control-circuits at board location thirty-five.

We have now used the block diagram to describe the logic boards involved in positioning operations.

Figure 3-43.

Turn to figure three-dash-forty-three in the Student Manual.

Another use of the circuits that monitor the servo-head, is generating clock-signals. Refer to coordinate four charlie. You will see that the quadbits from the servo-head in the H-D-A, go through the quadbit-servo-decoder at board location thirty-nine. This time, follow the line down the page to the index-bit-detector, also at board location thirty-nine. It monitors the servo-bytes for missing index-pulses.

To the right is a circuit labeled valid-index, at board location thirty-eight. Besides generating the index-pulse or index-mark, the circuits on this board monitor the guard bands. This is to determine whether the servo-head is over outer-guard-band one or two, or over the inter-guard band.

Also, the speed at which the index-mark is detected, allows it to generate the motor at speed signal. The output of the valid-index board, goes to the right as the index mark, to reset the sector-counter.

Now, refer back to coordinate four charlie. The output of the quadbit-servo-decoder at board location thirty-nine goes right to the write-P-L-O-servo-clock-circuits at board location forty. This is where the clocks are generated. When a certain number of clock pulses are counted, the board at location thirty-nine generates a sector-count-pulse. This is used to increment the sector-counter.

At board location twenty-eight is the block labeled sector mark and sector counter. Sector marks are generated to mark the beginning of each of the thirty-four physical sectors. To the right, is the block labeled sector-mark-on-sector-read-write- control. The sector-mark goes through this board at location twenty-four to bubble-nine and to the channel transmitters.

The sector-counter, at coordinate charlie three, is counting the thirty-four sectors. The output of the sector-counter at bubble-three, goes to the sector-compare circuit at coordinate two bravo. The other input to the sector-compare- circuit is the target-register, which contains the sector-address sent by the controller.

The sector-compare-circuit compares the count in the sector-counter with the sector-address. The output of the sector-compare-circuit is called on-sector. This only occurs when the sector-counter and the sector-address are equal.

The on-sector-signal bubble-four, is at coordinate two charlie, board location twenty-four. From there, the on-sector- signal goes through bubble-nine to the channel transmitters at board location three. The on-sector signal notifies the controller that the proper sector is available for a read or write operation to begin.

We have described positioning the heads to the proper cylinder and how the desired sector was located.

Figure 3-44.

Turn to figure three-dash-forty-four in the Student Manual.

At co-ordinate two charlie in the block diagram, locate the head-address register. Because this is a serial-disk, one head must be selected before a write or read operation can begin. One of the movable heads, head-zero-through-thirty-nine, may be selected. This is done by taking the output of the head-address-register, at board location fifteen, to the right as HAR, one-through-thirty-two, to the head-address-register decoder at board location sixteen.

This board sends a signal through the deck-head-selection-board to choose the head in the H-D-A. If one of the fixed heads is selected, the bottom output of the head-address-register labeled, fixed heads, zero through sixty-three and sixty-four through ninety-five, goes to the right through the deck-head-selection-board.

The deck head-selection logic is on the board mounted beside the H-D-A. The select-signal then goes to the H-D-A. One of the movable or fixed heads must be selected before a read or write operation can take place.

Let's follow a write operation. In the block diagram, go to co-ordinate four bravo and locate the ten bi-directional lines from the controller. Find the signals labeled write-clock and N-R-Z-write-data. These signals are on the same lines as bus-bit, two-to-the-first and two-to-the-zero.

Also necessary for the write operation, is the control-select-command and the signal labeled write. The write-signal is on the uni-directional line from the controller at coordinate four bravo. The write-signal enables the write operation. The device sends the write-clock, at coordinate two charlie, to the controller, to run the timing during the write operation.

The write-clock sent to the controller is basically the same write-clock that comes back, as the write-clock to the device at co-ordinate four bravo. The write-clock-signal clocks the non-return-to-zero-write-data into the device.

Follow the write-clock and N-R-Z write-data lines to the channel-one-receivers at board location two. Then follow the two lines coming out of the bottom, labeled write-clock and N-R-Z-write-data, to the block labeled write-compensation at board location seven. The signals labeled early, on time, and late, go to a block labeled peak-shift-correction, which is also at board location seven.

The purpose of the write-compensation-logic is to compensate for a phenomenon called peak shifting. This means the read-write wave shape gets very distorted because of the inductance of the read-write-coil, and the magnetic characteristics of the disk. To compensate for the distortion, the pulse is written earlier, on time, or later, depending on the data pattern. Some data patterns are more sensitive than others. For additional information on peak-shifting, please consult the theory of operation manual.

The write-compensation and peak-shift-correction-circuits also take the non-return-to-zero-data, and put it in the M-F-M, or modified-frequency-modulation, format that is used for recording on the disk surface. The write-data goes through the deck-read-write-board to the H-D-A itself. This is the path that the write-data takes through the block diagram to get from the controller to the selected head.

Figure 3-45.

Turn to figure three-dash-forty-five in the Student Manual.

Before a read operation can begin, the controller will send a control-select-command. At coordinate one charlie, one of the heads must be selected. At coordinate four bravo on the uni-directional lines, the read-signal enables the read-logic. The fast-start-signal is on the bi-directional lines. This signal is sent to the device only when reading data fields. It is issued in the gap between the address-and-data-field.

At coordinate four alpha, the read-data from the selected head in the H-D-A, comes through a block labeled, preamp- on-deck-cards. This logic board is mounted beside the H-D-A. The read-data goes through the A-G-C, or automatic-gain-control-circuit, at board location ten. From there, the data fans out to two places. The data fans out to the low resolution read-data-decoder at board location nine, and to the high resolution read-data-decoder at board location ten.

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The analog-read-data from the heads is quite distorted because of peak-shifting. The high and low resolution circuits are then used to clean up the wave shaped, and send it to the read-data-separator and master-phase-lock-oscillator-circuit, at board location eleven. The read-data to the data-separator is in the M-F-M format. Coming out of the read-data-separator, the data is in the non-return to zero format.

The read-clock is generated by the P-L-O portion of the board. These signals go through the write-compensation board at location seven. They do not go through the write-circuits on the board. The read-data-and-clock, goes out to the I-O buffer board at location twenty-one.

Follow bubble-eight to coordinate four bravo as bus-bits, two-to-the-zero and two-to-the-first, to the channel-one-transmitters. Continue through the channel-one-transmitters, up and to the left, as read-clock and N-R-Z-read-data, to the controller. This is the path read-data follows from the selected head in the H-D-A to the transmitters and the controller.

This completes Learning Activity Three -K- Detail Block Diagram of the eight-eighty-five CYBER Fixed Module Drive. If you want to listen to the tape again, you may do so. Then go to Learning Activity Three -L- in your Student Manual, the detail block diagram review exercise.

LEARNING ACTIVITY 3-M. BASIC POWER SEQUENCE

This learning activity describes the eight-eighty-five-CYBER-Fixed-Module Drive-Power Supply-Diagrams. These block diagrams are figure three-dash-forty-six through figure three-dash-fifty-two in the Student Manual. If you are not now at figure three-dash-forty-six in the Student Manual, stop this tape and go to that page.

Figure 3-46.

Along the sides of the diagram you will notice the letters A, B, C, and D. These letters will be referred to as alpha, bravo, charlie, and delta. Across the top and bottom of each diagram are the numbers one, two, three, and four. This is the coordinate system for locating signals and components in the power supply diagrams. We will be using these letters and numbers as we go over the diagrams.

While going through this learning activity, you may stop the tape to make notes or study. You can rewind the tape and go back over material, or you can go back over the entire tape at your convenience.

At coordinate four alpha, figure three-dash-forty-six, is the title D-C Power Supply. If you turn the page, you'll find figure three-dash-forty-seven titled Power-on. Figures three-dash-forty-seven

Figure 3-47.

through three-dash-forty-nine are all the same power-on diagram. Each diagram has a different highlighted area on it. We will be describing these highlighted areas as we go through the learning activity.

Figure 3-50.

Now to figure three-dash-fifty in your Student Manual.

There you will find a third type of diagram entitled power-complete. Figures three-dash-fifty through three-dash-fifty-two are all the same-power complete diagram with different highlighted areas.

Figure 3-46

Now turn back to figure three-dash-forty-six.

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At coordinate four alpha, find the three-phase, four-hundred-hertz-input. The circle with a three in it, indicates three lines. Follow the line at the right through A-seventeen -C-B- two. The A-seventeen tells us that the circuit breaker is part of the A-C-power-supply.

Remember, that all components of the F-M-D have an alpha numeric physical-locator-code. As you recall from previous learning activities, an A-seventeen or A-two code, tells us the component is part of the A-C power supply. The A-three or A-four code, tells us the component is part of the D-C-power-supply. The A-five or A-six code, tells us the component is on the string or unit-power-sequence-board. Follow the four-hundred-hertz-line further to the right, and you will see it going through the contacts of relay A-seventeen-K-three. Later in this learning activity, you will see how A-seventeen K-three is energized. For now, you'll assume that the three-phase four-hundred-hertz-signal gets through the contact, and continues through the circuit breakers, to the servo-transformer, A-seventeen -C-B- four, and the logic-transformer, A-seventeen-C-B-three.

These signals go to the logic-transformer, A-four-T-one, and below, to the servo-transformer, A-four-T-two. The output of the transformers, are the logic voltages of the D-C power-supply.

At coordinate three charlie, notice the A-three-A-two mother board for the plus-and-minus-five-volt-regulators. These are the adjustable five-volts for device-B. Directly above, is the plus-and-minus-five-volt-regulators, on the A-three-A-one mother board for device-A.

At coordinate two and three are the hi-lited-switch-contacts. These are contacts of the D-C-power-switch. The switch enables the D-C-voltages to go to one or both devices. The switch-contacts are shown in both positions.

At coordinate one delta, there is the C-S-W-V-circuit and the A-three-A-five transmitter enable. The output from here, goes to the enable A and B transmitters.

At coordinate one alpha and bravo are the B-Y-U-V circuits the A-three-A-three and A-three-A-four power-amp-boards. The voltage generated by the positioning logic, signal A and B drive, is amplified and sent to the A and B voice coils. Twenty- one-volts and minus-thirty-six volts, enable the power-amp-boards.

At coordinate two charlie and bravo, are terminal boards. These terminal boards are where the wires are physically connected and fan out. They are labeled A-four-T-B-six, A-four-T-B-five, and A-one-T-B-one. Although it is not shown in the diagram, voltages from the terminal boards fan out to the logic chassis and the F-M-D circuits.

At coordinate three alpha and bravo are the D-C power supply circuit breakers. Beginning at the bottom of the page, is A-four-C-B-nine, minus thirty-six-volts for device B. Above that, is A-four-C-B-eight, minus thirty-six-volts for device A. Continuing up the page, is the plus-twenty-four-volt-circuit-breaker, the minus-twenty-one-volt-circuit-breakers for device A and B, and the plus-twenty-one-volts-circuit-breakers for device A and B. To the left of the mother boards are circuit breakers for plus-ten and plus-twenty-one volts.

Figure 3-47.

Now turn to figure three-dash-forty-seven in the Student Manual.

At coordinate four delta, you see the same four-hundred-hertz-input as on the D-C-power-supply page. A-seventeen-C-B-two and the contacts of A-seventeen-K-three were also shown on the D-C-power-supply page.

Let's follow the four-hundred-hertz-line down the page, through A-seventeen-C-B-five to the plus twenty-four -Y-power-supply. The output then goes through circuit breaker A-seventeen-C-B-six as plus twenty-four-Y-. The plus twenty-four -Y-, fans down the page, over to the right, and through the bottom wafer of the power enable switch. This lights the power enable indicator. The switch shown, is in the power enable position.

At coordinate four charlie the sixty-hertz-three-phase-input, goes through the R-F-I filter box and A-two-C-B-one. At this time, the relay A-two-K-one has not energized, so take the tie point and go to the phase-rotational-sense box. This circuit is sensing the three-phase-sixty-hertz-input. This will ensure that the three-phases are present, and connected in the proper phase relationship.

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This circuit generates the signal phases ok, which goes to the right to energize relay A-two-K-five. Notice right above the relay A-two-K-five are the relay contacts. These contacts are shown in the normally opened position. Since the relay has been energized, they will now be closed.

Figure 3-48.

Turn to figure three-dash-forty-eight in the Student Manual.

At coordinate one bravo find the local remote switch. There are three wafers to this switch. Beside the word local, is an arrow that indicates the switch is in the local position.

Find the ground tie point and follow it through the middle wafer of the local remote switch. Continue following the ground signal through the diode, up the page to the next tie point, and then left, to the power-on-switch.

A remote-power-on, would get us to this same point, but we would begin, by following a ground signal on the pick-in-line, from controller A or B, through the top wafer of the local-remote-switch, in remote position. The ground signal, then goes through the top contact of the power-enable-switch, and the closed contacts of relay A-two-K-five.

Follow the line through the bottom contacts of A-two-C-B-seventeen. This is the blower-motors thermal-protect-circuit. If the blower overheated, it would block the ground signal from passing through A-two-C-B-seventeen. If you go up the page, to the logic-chassis-thermal-sensor it should be closed if the logic-chassis has not overheated.

The ground signal will energize the relays A-two-K-one and K-five-O-two. The left side of the relays were already tied to the plus twenty-four -Y-. The contacts of relay A-two-K-one are at coordinate four charlie. When the A-two-K-one contact closes, the sixty-hertz three-phase-signal is connected to the blower. The F-M-D's blower is now on.

Relay K-five-O-two is located on the A-five-string-power-sequence board. The contacts of relay K-five-O-two are directly above the relay at coordinate three charlie. The plus- twenty-four-Y from the plus-twenty-four-Y power supply now goes through the closed contacts to a tie point.

Follow the line, down the page to another tie point, and down, to turn on the power-on-indicator. This signal goes to point B, where you are told it's going to the power-complete page of our power supply diagrams. We will return to this in a few minutes.

Now, return to coordinate two charlie. Follow the plus-twenty-four-Y-frame-sequence signal into the circuit-breaker-interlock-circuit. Through it, we will energize the relays A-two-K-two and A-seventeen-K-four. The contacts for relay A-two-K-two are at coordinate three charlie. When these contacts close, they will enable the three-phase-sixty-hertz-signal, to more relay contacts. These relays will have to be energized before drive-motor A or drive-motor B can turn on. Turn to figure three- dash-forty-nine in the Student Manual.

Figure 3-49.

Go to coordinate three charlie, and locate the A-seventeen-K-four contacts. The closed contacts will allow the plus-twenty-four-Y- to energize the relay A-seventeen-K-three.

Remember that the relay contacts for A-seventeen K-three were shown on the D-C-power-supply diagram. They allow the four-hundred-hertz to turn on the D-C-power supply.

You will find another set of A-seventeen-K-three contacts at coordinate four delta. The four-hundred-hertz line goes through the now closed A-seventeen-K-three contacts, through circuit breaker A-seventeen-C-B-four, to the plus-twenty-four- volt-transformer, A-four-T-two. This was also shown on the D-C- power-supply page.

The output of the plus-twenty-four-volt-transformer goes to the plus twenty-four-volt-power-supply, A-four-A-one. The output is twenty-four-volts-local through circuit-breaker, A-four-C-B-seven. This line goes down the page, and across to the lower left corner.

At coordinate four alpha is point A which continues to the power-complete sequence page. Directly above, is the relay A-six-K-four which will energize when the plus-five-volts for either device A or device B is sensed.

Figure 3-50.

Turn to figure-three-dash-fifty in the Student Manual.

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Figure three-dash-fifty is the first page of the power-complete diagrams. At co-ordinate one delta, is point B from the power-on diagrams. Follow point B, across the page to plus-twenty-four-Y-frame-sequence. Continue following that, down the page to relay A-six-K-three-which is the frame sequence delay.

To the right is a one second delay. After the one second delay, relay A-six-K-three will energize. Below this, is a set of normally closed A-six-K-three contacts, that will now open.

Further down is a set of A-six-K-four contacts. The A-six-K-four relay was shown on the power-on diagrams page, and it will energize when the plus-five-volts are sensed. When A-six-K-three and A-six-K-four are energized, this will turn off the frame check L-E-D, or light emitting diode.

Above the relay A-six-K-three, is another set of contacts. The plus twenty-four-Y-frame-sequence-signal will pass through these contacts, across the page to coordinate one delta, and light the frame-sequence-complete L-E-D. At the tie point before the L-E-D, follow the line down the page, to the right, and through the contacts of relay A-six-K-seven. This will energize A-six-K-two, allow-start.

Below, and left of the relay A-six-K-two, is a set of contacts that will now close. The plus twenty-four-Y-signal will pass through those contacts, to the right, through the normally closed contacts of A-six-K-six, and energize relay A-six-K-seven, start-devices. This will open the set of contacts to the left of relay A-six-K-two, and the allow-start-relay will de-energize. The start devices relay will remain energized, because underneath relay A-six-K-two, is a tie point. If you follow the six o'clock input to the tie point, you'll find the holding set of A-six-K-seven contacts. These contacts are now closed to keep the plus-twenty-four-Y-signal on relay A-six-K-seven.

Figure 3-51.

Turn to figure three-dash-fifty-one in the Student Manual.

At coordinate four delta, is point A, labeled from-the-power-on-page. Follow the line labeled plus-twenty-four-volts-local, down to the three wafers of the device-D-C-power-switch. Below the switches are some special notations. The notes tell you that the device D-C-power-switch-contacts are shown with switches in both devices on, position.

Let's assume, for example, that we are only going to power-up device A. You would only go through the top wafer of the switch which is labeled A local. Following the plus-twenty-four- -Y- local signal to the right, you'll come to a tie point above the start-stop-switch. The two contacts of the start-stop-switch for device A, are drawn in the on position. The start indicator, through the bottom contact, will now turn on.

The plus-twenty-four-volts-local will pass through the top contacts of the start-switch, through the closed contacts of A-six-K-seven, to logic boards A-thirty-one, and A-thirty-two, as the start-signal. The off position of the start switch would send a stop signal to the logic boards.

The other input, is the signal called air from a switch below the start-switch. This is the H-D-A air pressure sensor. Across the bottom of the page at coordinate alpha, are similar circuits for device -B-.

The output of the A-thirty-two logic board, is the drive-motor-run-signal that energizes relay A-six-K-nine. To the right of relay A-six-K-nine, is a set of contacts that close, and allow the plus-twenty-four-volts local to energize the drive A brake relay.

The brake on the bottom of the drive motor is now released. Below the brake, the relay A-two-A-one-K-three energizes. For the contacts, refer back to figure three-dash-forty-nine, on the power-on page. When the A-two-A-one-K-three contacts close, sixty-hertz will be applied to drive-motor-A. Drive-motor-A will then start to rotate the H-D-A.

Figure 3-52.

Turn to figure three-dash-fifty-two in the Student Manual.

At coordinate two bravo, the output of logic-board -A-thirty-one is the H-D-A-sequence-complete-signal. This is generated when the device successfully completes the power-up rezero-seeking-operation. The H-D-A sequence complete-signal will energize relay A-six-K-eight. The relay contacts, at co-ordinate three delta, now close.

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For example, the device D-C-power-supply-switch, is in the A-only-position, so the plus-twenty-four-Y-frame-sequence can pass through the -A-six-K-eight contacts, as -A-only complete. This energizes relay -A-six -K-six, device-sequence-complete.

Below the relay, at co-ordinate two charlie, are the -A-six -K-six relay contacts. The plus-twenty-four-Y-frame- sequence-signal, can pass through these relay contacts, and generate the signal called device-sequence-complete, to point -C-. Point -C- goes to the power-on page.

Figure 3-49.

Turn back to figure to three-dash-forty-nine in the Student Manual.

At coordinate alpha one, point -C- enters the page from the power-complete diagram. It energizes the -A- five -O- one transfer-pick relay. Directly above, the relay contacts close so that the ground signal can pass through to the local remote switch. During a remote- power-up, the signal could pass through the bottom wafer of the local remote switch, and out, as the pick- out-signal to controller A or B. You have now finished a local-power-up-operation for device -A-, and have pointed out the remote and device -B- circuits.

This completes learning activity three-M- eight-eighty-five CYBER-Fixed-Module Drive-Basic-Power-Sequence-Diagrams. If you desire to listen to the tape again, you may do so. Then go to learning activity three -N- in your Student Manual, the basic power sequence review exercise.

LEARNING ACTIVITY 4-G. 7155 BLOCK DIAGRAM

This learning activity describes the seventy-one-fifty-five Controller Block Diagram. This block diagram is figure four-dash-thirteen in the student manual. If you are not now at figure four-dash-thirteen in the student manual, stop this tape, and go to that page.

Along the sides of the page, notice the letters a, b, c and d. We will use the terms alpha, bravo, charlie and delta when referring to these letters. Across the top and bottom of the page are the numbers one, two, three and four. This is the coordinate system for locating signals and blocks, and we will be using these as we go over the block diagram.

Turn the page and you will find figure four-dash-fourteen and so on. There are a total of six figures. All figures are the same block diagram with the same coordinate system on each page. Notice that different areas on each page are highlighted. As you go through this learning activity we will be describing the highlighted areas on each page.

Keep in mind that you may stop the tape to make notes, rewind the tape and go back over material, or go back over the entire tape at your convenience.

Figure 4-13.

Let's turn to figure four-dash-thirteen in the student manual.

In previous learning activities, you have studied the interface between the controller and the eight-eighty-five F-M-D device. You have also studied the interface between the P-P Channel and the seventy-one-fifty-five controller. Go to coordinate four delta, and you will see the P-P Controller Interface.

Only the Data Lines and Parity Bit is shown in this block diagram. There are four logic boards labeled CYBER one-Seventy Channel Receivers and Transmitters. The letters -A-A- tell us it is an -A-A- type of logic board. The designation, -A-oh one, indicates the logic board is at location one, of the -A- row. The logic board at location A-oh-one, contains the Receivers and Transmitters for the P-P channel on the -A- access.

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The Channel -B- Receiver and Transmitter board is at -A-oh-two location. The Channel -C- Receiver and Transmitter board is at location -A-oh-three and the Channel -D- Receiver and Transmitter board is at location -A-oh-four. All four logic boards will be present if the controller has the optional channel interfaces.

The standard controller comes only with the Channel -A- Receiver and Transmitter board at location -A-oh-one. The board at -A-oh-one must always be present because the signals are terminated at location -A-one only. The controller must have a Receiver and Transmitter board at this location. So when swapping logic boards during troubleshooting, remember, there must always be an A-A type of logic board in location -A-oh-one.

Go to coordinate one charlie and locate the eight-eighty-five F-M-D Interface Boards. Remember, the controller can normally handle eight F-M-D devices. As an option, up to eight additional F-M-D devices may be added to the controller. This block diagram shows the additional F-M-D devices.

At coordinate one charlie, there is a row of A-L type of logic boards. The boards at locations B-oh-one, -oh-two, and -oh-three, interface the standard eight F-M-D devices.

To the right, are the interface signals that you have studied in previous activities. Sixteen signals are indicated by the circle with the sixteen in it. They are ready-and-safe, write-clock, tag-valid, sector-mark or on-sector, index-mark, select-and-reserve, on-cylinder or on-track, bus-in-bits-zero-through-seven, and the parity bit. These are the signals that come from the selected eight-eighty-five drive.

Directly below, you see a group of twelve signals to the eight-eighty-five drives. They are tag-gate, read-gate, write-gate, bus-out-bits-zero-through-seven and the parity bit.

The A-L modules at location B-fourteen, fifteen, and sixteen, are the interface boards for the optional eight-eighty-five units-eight-through-fifteen. Before the controller can operate with an F-M-D device, it must select it.

The A-M modules above, and to the left, of the -A-L's, are the ones that send the select or disable reserve signal to the drives. The -A-M- module at board location -B-oh-four, is for eight-eighty-five devices zero through seven. To the right, the -A-M- module at board location -B- seventeen, sends the select or disable reserve signal to one of the optional eight F-M-D devices, eight-through-fifteen.

At coordinate one bravo and alpha there is a roll of -A-N- modules. Board locations -B-oh-five-through-twelve are added with the optional eight-forty-four interface. This allows the controller to interface with a maximum of eight, eight-forty-four drives.

This block diagram shows only four of the eight-forty-four interface signals. They are the write-data and write-clock to the drives, and the read-clock and read-data to the eight-forty-four drives. Actually, they are additional eight-forty-four interface signals, such as index mark, sector marks, and so on. These signals are not shown in this block diagram but are described in the eight-forty-four maintenance course.

Figure 4-14.

Turn to figure four-dash-fourteen in the Student Manual.

The heart of the seventy-one-fifty-five controller is the processor. The processor area has been highlighted in this figure. Locate the -A-J- modules at coordinate three charlie. There are four -A-J- modules at board locations -A-twenty- six, twenty-five, twenty-four and twenty-three.

The processor uses a sixteen bit word, and there are four bits per logic board; the bits are zero-through-three, four-through-seven, eight-through-eleven, and twelve-through fifteen. Each board is referred to as a four bit slice.

In addition to the processor logic circuits, the -A-J- boards contain the two -K- Random Access Buffer Memory. The memory locations are ten-thousand-through-thirteen-thousand seven-hundred-and-seventy-seven octal. It is used as a Data Buffer on write and read operations.

The -A-J- modules also contain the four -K- Random Access Memory. You will find it at memory locations zero-through-seven-thousand, seven-hundred-and-seventy-seven octal. This memory contains the M-A seven-twenty-one controlware program.

The -A-J- logic boards have Lite Emitting Diodes or -L-E-D-'s, on the front edge. The -L-E-D-'s are for the -A- Register the -P- Register. The -P- register displays the current four -K- memory address.

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To the left of the -A-J- modules at coordinate four bravo, is an -A-K- module at location -A-twenty-seven. It is labeled Program Rom and Parity Ram. This logic board contains the program one-K-Rom. The sixteen bit word rom, is memory location twenty-thousand through twenty-one-thousand-seven-hundred-and seventy-seven octal.

The Resident Rom controlware, includes a processor instruction-test, a drive-release-routine, a function-idle-loop, a routine-to-process-general-status, a clear-connected-access, an echo-one-word, an auto-dump, a manipulate-processor-and input-display-data, an autoload-from-disk, and an auto-load-from -P-P- frunctions. The logic board has -L-E-D's for Rom and Ram parity error indications.

To the right of the -A-J- module is the -A-H- logic board at location -A- twenty-two. This is the control memory which is a two-hundred-and-fifty-six-by-sixty-bit-word-microcode-read-only memory. The logic checks parity on every sixty bit-word-read from-memory, and lights the -L-E-D- if an error is detected.

When the processor executes a controlware instruction, it does not have hardware to decode the instruction, instead, it uses the control memory for instruction decode. The control memory sets appropriate bits in the processor hardware, to perform the instruction.

Above the control memory, is an -A-G- module at location -A- twenty-one, called Channel Control. Directly above that are four -A-F- modules at location -A- seventeen-through-twenty. These modules are labeled channel zero-through-three, four-through- seven, eight-through-eleven, and twelve-through-fourteen.

The channels are called Normal-Input and Normal-Output. The processor uses the Normal-Output channels to control the hardware of the controller and receive status from the rest of the controller on the Normal-Input channels. There are fifteen input and fifteen output channels. The octal code of the Normal-Input or Output channel, selected by the processor, is dis- played by -L-E-D's on the -A-G- logic board, at location -A-twenty-one.

Between the -A-G- module channel control, and the -A-F- processor channel modules, are the control signals that select the channel to be used. This block diagram does not show all the input and output channels, it only shows a selected few.

On the right hand side on the -A-F- module, there is a line showing the sixteen bits of normal output channel eight, bits zero through fifteen. Follow the line across the page to the A-M module as eight-eighty-five functions. Normal output channel eight, controls selecting the eight-eighty-five -F-M-D- device.

Notice, that on the left side of the -A-F- modules is a line going down to the -A-J- module. This sixteen bit line is labeled -D- bus. The processor uses the -D- bus to read the normal input channels, and to set bits in the normal output channels.

Figure 4-15.

Turn to figure four-dash-fifteen in the Student Manual.

At coordinate four delta, is an -A-B- module at board location -A-oh- eight, and it is labeled CYBER Channel Mux. This pack muxes the signals from -P-P- Channel Receiver and Transmitter boards to the Special CYBER Channel module to the Buffer Control board.

There are four switches on the -A-B- module to enable or Disable parity checking. Also, there are -L-E-D's on the logic board to indicate the A, B, C or D access connected.

There is another -L-E-D- that will light for an autoloading operation, and an -L-E-D- that will light if the logic senses a deadman timeout condition. The deadman timeout occurs when a P-P activates the controller, and stops transferring data for approximately five seconds. Also, there is a -P-P- Channel Parity Error Indicator that will light if there is a parity error detected on the CYBER one-seventy Channel.

The logic board at location -A- sixteen is an -A-D- module, labeled Buffer Control. This board, controls data transfers into and out of the two-K-Buffer Memory. The top two Inputs, on the right side, come from normal Output Channel six and Normal Output channel seven.

These are read-write address, and the up-down-count. The twelve bit write-data, from the channel, buffer memory, zero through eleven, becomes the sixteen bit output. E-X write data two-to-the-zero through the two-to-the-fifteenth, goes to the Buffer Memory.

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At coordinate three delta, is the -A-E- module labeled Special CYBER Channel at board location -A- sixteen. The Special CYBER Channel, also referred to as Channel sixteen, is a channel between the -P-P- and the processor. Notice that the top line on the left goes to the Channel Transmitter and that the bottom line comes from the Channel Receiver's through the CYBER Channel Mux.

The output, on the right, goes to or comes from the processor on the bi-directional line called the -D- bus. The processor communicates with the P-P, through the special CYBER channel.

At coordinate two bravo, is the -A-C- module, labeled error Correction at board location -A- twelve. This logic board has a forty-eight bit-check word generator used to detect and correct errors on Data Read from a disk. All forty-eight bits of the generator are used with the eight-eighty-five disk, but only thirty-two bits are used with eight-forty-four disks. The forty-eight or thirty-two bit-check-word is written on the disk at the end of the data field.

During Read's, the data and the check word is sent back to the generator. If the contents of the generator are zero at the end of the read, then no error was detected. If the generator does not equal zero, then the processor can determine if the error is correctable, and then correct it if possible.

Directly below, you will see the -A-T- module at location -B- twenty-two, labeled Data Path Control. The Data Path Control board is used during the write and read operations. The board has the Control Logic and Clock Circuits for controlling the write and read operation.

To the right at coordinate two alpha, is the -A-P- module, at board location -B- thirteen. The board is labeled eight- forty-four Interface Control, and is always present whether or not the controller has the eight forty-four option.

In addition to controlling unit selects on eight forty-four's and F-M-D's the board has the power loss detection circuit that protects the disk drive interface when applying or removing power from the controller.

A switch on the pack can disable the circuit when running voltage margins. The power-loss-detect-circuit disables, the eight-eighty-five's select-transmitters and the eight-forty-four open-cable-detect-transmitters, if power drops by more than five percent.

At coordinate three alpha, is the -A-S- module at location -B- twenty-one, labeled Buffer to Data Path Control. Directly above are two -A-R- modules, at locations -B- nineteen and twenty. They are labeled the Read-Write-Data Path boards. Bits, zero through seven, are on -B- nineteen, and bits, eight through fifteen, are on -B- twenty. The read/write data passes through the -A-R- modules controlled by the -A-S- module.

Figure 4-16.

Turn to figure four-dash-sixteen, in the Student Manual.

For the controller to function fully the controlware must be loaded. For this to begin, the -P-P- issues a function to load the controlware. The -P-P- will then output over fourteen thousand twelve-bit data words. The data words are then loaded into the -four-K- Ram Memory as the -M-A- seven-twenty-one controlware package.

The path that the autoloader function word or any function word takes, is from the -P-P-, at coordinate four delta, as a twelve-bit-word. It continues through the -A-A- receiver module for the appropriate access, to the CYBER Channel mux. The function word then goes through the Special CYBER Channel, -A-E- module, to the D-Bus, and the -A-J- module, four bit-slice processor. The processor will then decode the function.

If the function was autoloader the -P-P- would output the data words which would follow the same path to the processor, and the processor would then load them into the four-K-memory. The data word, sometimes called the parameter word, following the function, would follow the same path as the controlware to the processor.

Through the fifteen normal Input channels, the processor gathers status information and stores it in the memory. When the -P-P- issues a request, for a one-word-general-status, a twelve-word-detail-status, or a twenty-word-extended-detail- status, the processor outputs the word or words on the -D- bus, through the Special CYBER Channel, to the Channel Transmitters on the -A-A- modules.

Figure 4-17.

Turn to figure four-dash-seventeen in the Student Manual.

CYBER Fixed Module Drive Appendix D

We will assume that the controller has issued a write function. The processors program has decoded the write function, and through the output channels, has set up enables for the write operation. The -P-P- then outputs the Write Data, and twelve bit words that go through the -A-A- module at coordinate four delta for channel A, B, C, or D.

The data goes to the -A-B- module CYBER Channel Mux, and down on the line labeled Buffer Memory, bits zero-through-eleven, to the -A-D- module, Buffer Control. It continues out the third line on the right as E-X write-data, two-to-the-zero through two-to-the-fifteenth. Actually, there are twelve used bits and four zero filled bits to make up the sixteen bit word.

The write data is put into the two-K-Buffer Memory on the A-J modules. From this memory, the sixteen bit word labeled bits-zero-through-fifteen goes to the -A-R- modules. The -A-R- module takes the sixteen bit word from the buffer memory, and shifts it serially out on the line labeled Data-Out-write. This line goes right to the -A-T- module Data Path Control.

Coming out of the top of data path control is Write Data to the Error Correction Board. All three-thousand -eight-hundred-and-sixty-four bits of the data field, will be shifted through the error correction circuit. Meanwhile, the Data goes out the right side of the -A-T- module as Data Out, and Write Clock out.

If you follow the line to the right, you'll notice that it goes to both the eight-eighty-five and the eight-forty-four interfaces. The serial write operation will take place only on the selected disk pack. At the end of writing the data field, the contents of the Error Correction board will be shifted serially through the -A-T- module to the drive interfaces.

Figure 4-18.

Turn to figure four-dash-eighteen in the Student Manual.

Whether at coordinate one charlie for the eight-eighty-five drives or at one bravo for the eight-forty-four drives, the Read Clock and Data will pass through the receivers on the -A-L- or -A-N- modules.

The eight-eighty-five Read Clock and Data goes to the -A-T- module at location -B- twenty-two. The eight-forty-four Read Clock and Data, goes through the -A-P- module at -B- thirteen, eight-forty-four Interface Control, to the -A-T- module at -B- twenty-two, Data Path Control.

As you continue out the left, the serial read-data goes to -A-R- modules, at -B- twenty and -B- nineteen. The read-data goes through a Deskew and shift register to be put in parallel format, sixteen bit word, twelve good bits and four zero fill bits. The read-data takes the top line out on the left of the -A-R- modules, labeled Deskew zero through fifteen, and goes into the -A-D- module at -A- fifteen, Buffer Control.

The read-data takes the line labeled, Write-Data, two-to-the-zero and two-to-the-fifteenth, to the -A-J- modules of the processor. The Read-Data is put into the two-K-Ram buffer memory. From there, the sixteen-bit-word, bits zero-through-fifteen, comes out of the -A-J- modules to the -A-R- module.

The Read data comes out of the -A-R- module, as Buffer Data, zero through eleven plus the parity bit and goes up to the -A-A- modules. Here, the Cyber one-seventy Transmitter boards, sends the twelve bit words, and the parity bit on the channel to the -P-P-.

This completes Learning Activity Four G - Seventy One Fifty-five Block Diagram. We have described the major purpose of the logic boards that make up the seventy-one-fifty-five-controller, and have followed the path of the function words, status words, parameter words, and read-write-data, through the block diagram.

You may now rerun the tape, at your convenience, to review the material.

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